

# **The United States – Greek Initiative for Technology Cooperation in the Balkans (The ITCB)**

Report of Accomplishments  
1998-2003

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## **Forward**

This report recites the origin, history of accomplishments, and future initiatives of the US-Greek Initiative for Technology Cooperation (the ITCB), a joint undertaking of the governments of Greece and the United States begun in 1998, and renewed in 2003. Periodic updates of information and activities may be found on the website of the Greek ITCB Secretariat: <http://www.itcb.gr> or the link with the U.S. Department of Commerce Technology Administration: <http://www.technology.gov/International/Europe/ITCB.html>

The Greek ITCB Secretariat was formed as part of the original governance structure of the ITCB at the time of its creation and is located at the Technology Park in Thessaloniki, Greece. The US ITCB Secretariat was created in 2001 under the auspices of the Technology Administration, the U.S. Department of Commerce and is headquartered in Boston.

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## **I. History and Purposes of the ITCB**

As a result of direct negotiations in 1997, former President Bill Clinton and Greek Prime Minister Costas Simitis jointly proposed the establishment of the United States-Greek Initiative for Technology Cooperation with the Balkans (the ITCB). The ITCB was established in order to (1) promote economic stability, restore peace, and facilitate peaceful transition to free enterprise economies in the Balkan Region; (2) strengthen the friendship and understanding in the relationships among the US and Greek private-sector firms and among private and public entities in the Balkan Region; (3) provide economic benefits to the Balkan Region, and (4) promote collaboration and cooperation among technology and industrial organizations, researchers and engineers for the benefit of the Balkan region.

A memorandum of understanding was signed in January 1998 (Appendix A) and a six-person Joint US-Greek Council was established and charged with implementing the ITCB in order to enhance technological capabilities in the Balkan region, improve the relationships between U.S. and Greek private sector firms and entities in the Balkan region, and take specific actions to promote the development of stable, free market economies in the Balkan region.

The Council, composed of academic and business members, identified as top priorities bilateral efforts focused on the Balkans to improve (1) the environment, (2) information and communication technology (ICT), (3) food processing, and (4) agricultural infrastructure in the region. Other areas were to be developed, as needed.

The US and Greek bilateral efforts were to intended to emphasize the creation of multilateral partnerships with the countries of the Balkan region involving both private and public sector institutions and persons, academic/research institutions, and other multilateral initiatives in bringing and developing technologies to benefit nations of the region, with initial emphasis on Albania, Bulgaria, the Former Yugoslav Republic of Macedonia (FYROM), and Romania. In 2003, the Council unanimously agreed to expand the countries of interest to Serbia and Montenegro. Bosnia is anticipated to be added to the list of target countries.

ITCB financing in its initial stages was provided by the Hellenic Ministry of National Economy, the Hellenic General Secretariat for Research and Technology, and the Technology Administration in the US Department of Commerce.

## **II. Commentary by the US ITCB Secretariat**

The Council's aim is not limited to providing contact between U.S. and Greek institutions and their various Balkan counterparts. It will also serve as a discussion forum and information transfer source for new ideas about enhancing the region's technological opportunities and capabilities. Both private sector partnerships and public-private ventures are expected to help stabilize and develop the region through meeting the essential needs of the people of the region. Greece is in a unique position to assist in both confidence-building measures and capacity-building measures with both the Albanian and Slavic peoples to its north.

Several key points about the ITCB initiative should be emphasized:

- 1) While the private sector is seen as the dominant and an indispensable vehicle/instrument for technology transfer to the Balkans, the beneficiaries must be understood to be the people of the region. For this reason, a 'technology needs assessment' was undertaken under the leadership of Professor Iacovos Vasalos at the Technology Park in Thessaloniki, the designated Greek Secretariat for the ITCB.
- 2) The approach is not meant to be 'top down', but needs to involve the various stakeholders: industry, all levels of government, scientists and academicians, NGOs, and labour organizations. (It is important to note that academicians in the region are very often also technology business stakeholders.) In order for the initiative to be successful, the stakeholders need to "own" the various projects. Getting the different stakeholders to reach a consensus in a region where consensus is a foreign concept is no small challenge. The building of a strong, law-based civil society is essential in this regard. For example, in the environmental area, regulatory systems and technical assistance capacities appropriate to the culture of the Balkan region need to be established and coordinated.
- 3) Aside from individual projects, emphasis will be put on capacity-building and self-reliance that goes beyond specific projects.
- 4) The emphasis is intended to be on Technology for Sustainable Development in terms of three dimensions: (a) the establishment and growth of enterprises and markets, (b) environmental and public health improvements, and (c) creation and improvements in the labour markets.
- 5) The establishment and strengthening of both public and private-sector infrastructure deserves a central focus -- including, but not limited to, vehicles for micro-, meso- and macro-credit; confidence and consensus building; environmental and resource management laws and institutions; and transportation. "Leap-frogging" needs to be conceptualized both in terms of specific technology adoption -- and in terms of institutional and individual capacity-building.

6) An important enabling element in the ultimate success of the ITCB initiative is education -- from grammar school to vocational schools to universities. While education is beyond the specific charge of the ITCB, Greece itself is in a unique position to help build English-language literacy and to help create institutions which depend on instruction in a variety of fields, using English as a potential unifying factor in the Balkans. More directly related to its mission is the training of science/technology policy analysts and designers to staff public and private sector initiatives for technology transfer and development to aid the Balkan region.

7) Ultimately, the long-range expansion of the European Union (EU) to include the countries of the region is in the interests of both the US and Greece. The ITCB initiative is intended to be coordinated with efforts of the EU and other activities already underway, such as those of the UN Environment Programme, the Southeastern European Cooperative Initiative, and the Stability Pact for Southeastern Europe, among others.

Rather than a program of activity that competes with these much larger efforts, the ITCB should be seen as a catalyst and broker among the different initiatives and stakeholders. One activity currently underway the establishment of a comprehensive web-site that links to these other programs as, well as to possible sources of funding for specific projects.

8) US-Greek partnerships and public-private partnerships are key elements of success, but it must be recognized that a central concern of the private sector is security of investment, a supporting infrastructure for the delivery of goods and services, and legal norms and institutions.

### **III. Governance**

The ITCB is administrated the Joint Council and the ITCB Secretariats.

#### **A. The Joint Council**

The Joint Council is the governing board of the ITCB, established under the terms of the memorandum of understanding.

##### **1. Objectives and duties of the joint council.**

The Joint Council holds meetings at periodic intervals to:

- Recommend overall policies to the two governments
- Identify areas of cooperation
- Review, assess and make specific recommendations concerning cooperative activities
- Prepare periodic reports concerning the activities of the Joint Council.

## 2. Members and chairpersons (see Appendix B for brief biosketches)

The Joint Council consists of six members, three permanent members designated by the Greek Ministry of National Economy, General Secretariat for International Economic Relations and three designated by the U.S. Department of Commerce, Technology Administration. Two co-chairs are elected by the members, one from each side. In addition, there are also alternate members on each side.

For the U.S. side, the current permanent members are:

- **Mr. Constantine Aloupis**, Managing director Motorola, Greece.
- **Professor Nicholas A. Ashford**, Massachusetts Institute of Technology, Center for Technology, Policy and Industrial Development, *US ITCB co-chair*.
- **Mr. Manuel Stefanakis**<sup>1</sup>, Director, Sustainable Strategies International

The alternates are:

- Professor **Charalabos C. Doumanidis**, Professor of Mechanical Engineering, Nicosia, Cyprus
- Professor **Panos Hadjimitsos** Program Director, Electronics and Computer Technology, DeVry University, Buffalo Grove, Illinois
- Mr. **John Sitilides**, Executive Director, Western Policy Center, Washington, D.C.

For the Greek side, the current permanent members are:

- **Professor George Chryssolouris**, Department of Mechanical Engineering, University of Patras, *Greek Co-chair*.
- **Professor Pantelis Lazaridis**, Rector, University of Thessaly.
- **Professor Vasilios Papageorgiou**, Dean, Department of Engineering, Aristotle University of Thessaloniki.

The Greek side has also designated two alternate members:

- **Professor Ioannis Kontoleon**, Department of Electrical and Computer Engineering, Aristotle University of Thessaloniki.
- **Professor Christos Zerefos**, Department of Physics, University of Athens.

In addition, the Under Secretary of the Technology Administration of the U.S. Department of Commerce and the General Secretary for International Economic Relations in the Ministry of National Economy are ex-officio members of the Joint Council.

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<sup>1</sup> In October 2003, Mr. Stefanakis replaced Mr. Sotirios Yiannopoulos, General Director, American-Hellenic Chamber of Commerce when he resigned from that organization.

## **B. The ITCB Secretariats**

The Greek ITCB Secretariat was established in 1998 in the Center for Research and Technology Hellas in the Thessaloniki Technology Park to assist the operation of the Joint Council. The activities of the Secretariat include the following:

- Undertake studies related to the ITCB objectives
- Recommend policy matters to the Joint Council
- Coordinate actions with other initiatives
- Coordinate the preparation of proposals for ITCB recommendations for support
- Supervise the implementation of projects under the ITCB support.

The Greek Executive Secretary of the ITCB in the Technology Park of Thessaloniki is Professor Iacovos Vasalos, professor in the Department of Chemical Engineering of Aristotle University of Thessaloniki and director of the Center for Research and Technology Hellas in the Thessaloniki Technology Park.

Professor Yiannis Bakouros, Department of Mechanical and Industrial Engineering, acted as coordinator for the Greek ITCB Secretariat.

In 2001, the Technology Administration, Department of Commerce appointed Ashford Associates, a non-profit research organization as the US ITCB Secretariat. Its President, Nicholas A. Ashford, is administrator of the secretariat. The tasks delegated to the US ITCB secretariat include:

- management of funds made available to the US Secretariat
- meeting with the Department of Commerce, Technology Administration on a periodic basis
- project oversight
- acquisitions of documents and studies
- disbursement of funds for studies, the attending of meetings, workshops, and conferences by researchers, scientists and engineers
- travel of members to ITCB meetings, workshops, and events
- the evaluation of proposals for funding or promotion to other entities for funding
- coordination with the Greek ITCB Secretariat

## **IV. Activities**

### **A. Technology-related studies**

#### ***Technology Audits in Four Balkan Countries***

Following the 2nd meeting of the Joint Council on in March 2001, it was decided that the first necessary step for the initiative was to perform extensive technology assessments (technology audits) in the relevant industrial sectors in the Balkan region. The Centre



for Research and Technology Hellas – with funding from the Ministry of Economy of Greece – was responsible for the implementation of five studies under the title “Assessment of the technology competencies and needs of the 4 Balkan countries Albania, Bulgaria, FYROM and Romania in the sectors of Information Technology, Telecommunication, Food and Beverages, and Agriculture, Environment”. Following a call for tender, the studies were awarded to two bidders:

- Consortium of [Euroconsultants S.A.](#) and [Planet Ernst and Young S.A.](#) for Albania, FYROM and Bulgaria.
- [TREK Business Consulting](#) for the study of Romania.

The two groups presented the results of the first phase (interim report) of their project during the 2nd Joint Council meeting in Athens. The final results were presented during the 3rd Joint Council meeting in Thessaloniki Technology Park on March 30, 2001 before a wide audience with representatives from the four countries, as well as from the business and research community of Greece.

Presentations:

- [Albania, FYROM and Bulgaria](#)
- [Romania](#)

In addition, shorter [study reports](#) were prepared for each sector. These are reproduced here as Appendixes C through G.

### ***Information and Communication Technology Development in the Balkans***

An MIT master's thesis by Christos D. Sermpetis entitled: *Information and Communication Technology Development in the Balkans: System-wide Policy Guidelines for the Development of Information and Communication Technologies in Countries of South-Eastern Europe and Analysis of the Suitability of Public-Private Partnerships* was funded by the Southeastern Europe Telecommunications & Informatics Research Institute (INA Telecom) and cosponsored by the ITCB. The thesis is found in Appendix H.

### **B. Forums, seminars, and conferences**

One of the most important parts of ITCB activities is the organization of events with technological content, forums, conferences, and seminars. The purpose is to inform the business and research community of the Balkan countries on the latest developments in the relevant technological sectors and to facilitate cooperation and exchange of experience. The initiative is not limited to information exchange - the objective is that during these meeting real business projects will be proposed, discussed and brought into implementation. Thus far, the ITCB has organized and/or participated in the following events:

●Lecture of Thomas Acker, founder of the [National Technology Transfer Center of U.S.](#) Topic: "Establishing a National Technology Transfer Center: Some lessons learned", 31 March 2000.

●Forum in biotechnology in cooperation with the American Consulate in Thessaloniki, Water resources management and Informatics, 18 May 2000.

●Workshop with topic: "[Development and transfer of technology in Balkans](#)", 30 March 2001.

●Conference in cooperation with the American-Hellenic chamber of Commerce: "Professional Womens' Forum", 7/8 May 2001, Sofia, Bulgaria.

●International conference: "New development in Research and Innovative products in information, environmental, agrobio and water management technologies", 22 June 2001.

●Workshop with topic: "Precision agriculture - The next agriculture revolution", 28 June 2001.

●Forum in Agrobiotechnology, 20 September 2001, Thessaloniki Technology Park.

●Participation in the [Third regional Information society forum in Bulgaria](#), "[Role of women in technology based business - Conference](#)", 28/29 March 2002, Sofia, Bulgaria.

### **C. Sponsorship of Cooperative Projects**

At its present level of funding, the ITCB itself is not currently in a financial position to support large-scale projects, but it regards a central mission of the ITCB to assist organizations and individuals in making contacts with persons, agencies, trade associations, industry/private sector entities, and multilateral or international organizations that could offer financial support. Occasionally, funding for small seed projects or proposal support may be forthcoming. Applications describing projects or proposals seeking ITCB approval should follow the format outlined in Appendix I. Two examples of projects sponsored by the ITCB are:

- Use of wetlands for the primary cleaning of Axios river waters in cooperation with the Greek National Center for Wetlands and Biotopes ([EKBY](#)) and the [University of Florida Center for Wetlands](#).

- Use of precision agriculture technology for increasing crop productivity in cooperation with the [American Farm School](#) in Thessaloniki and the University of Georgia in Athens.

## **V. Future and Developing Activities and Initiatives**

### **A. Establishment of a Balkan Technology Documentation Center**

ITCB has prepared a proposal to create a technology documentation unit for the Balkan region. This unit shall engage in collecting, analyzing, and providing access to technological needs/opportunities and capabilities.

The services that the documentation unit will provide include:

- Recording of Public and Private Technological Institutes, Organizations, Laboratories and other Technological agents.
- Recording of Public and Private Development Agencies and Funding Organizations.
- Full Technical Diagnoses that involve the systematic and ongoing analysis and recording of the existent technological status (ongoing SWOT analysis).
- Scientific and reliable recording of Technology Evolutions and Quests in the Balkans
- Technology Foresight Reports
- Studies concerning Technology Development in the Balkans.
- Systematic preparation and issuing of information on Technology Issues

The services, studies and reports shall be provided through the ITCB Web Site. The architecture of the unit shall be based on an antenna structure. Technology observatories will be created in each country to collect information and perform initial analysis. The Center of Research and Technology Hellas (CERTH) will be the information concentration point and will coordinate and supervise the operation of the technology observatories.

### **B. Balkan Research Centres Databases**

The Centre for Research and Technology Hellas is currently creating a database of the research centres/institutes/organisations in the Balkan region. The goal is to increase awareness of present research activity in the region and to facilitate networking and cooperation among the research organizations in the region in view of the existing opportunities that arise from the 6th European Research Framework Program and other regional and international organizations. The database will be a free open source of information for anybody interested in identifying partners. During the first phase the ITCB countries will be covered with the intention to extend to the remaining countries soon.

### **C. A Human Resource Development Initiative for the Balkans**

Access to, or availability of technology-based information by itself does not guarantee effective utilization of science and technology information. What is needed to translate technology needs and capabilities into specific proposals, projects, and initiatives in the Balkan region requires scientifically/technologically literate policy analysts and designers, in addition to technically-trained specialists. ITCB has prepared a proposal for a Human Resource Development Initiative for the Balkans designed to educate and train the needed policy experts.

The Massachusetts Institute of Technology (MIT), in cooperation with the University of Thessaloniki and the University of Macedonia, the Southeast European Telecommunications Academy, and with Balkan institutional partners propose to undertake the education of 2-3 candidates per year in the MIT TPP masters degree program to serve as a core resource to further the purposes of the Initiative for Technology Cooperation with the Balkans. A three-year commitment is sought at a funding level of 150,000.00 dollars per year. MIT will contribute the services of Professor Nicholas A. Ashford, who will supervise the theses of the candidates on Balkan-related science and technology issues. Support is sought (1) to provide tuition and living expenses to the Balkan students at MIT and (2) to provide financial support for those students for internships in the Balkans. The candidates will take formal instruction at MIT for a nine-month academic year, followed by a practical applied internship at the Thessaloniki Technology Park, the University of Thessaloniki, the University of Macedonia, the Southeast European Telecommunications Academy, and other Balkan centres, government entities, and the private sector, as appropriate. A final formal thesis focused on science and technology issues in the Balkans will be written following the internship.

## **APPENDIX A**

### **MEMORANDUM OF UNDERSTANDING BETWEEN THE UNITED STATES DEPARTMENT OF COMMERCE AND THE GREEK MINISTRY OF NATIONAL ECONOMY CONCERNING TECHNOLOGY COOPERATION WITH THE BALKANS**

(hereinafter to be known as “The United States - Greek Initiative for Technology Cooperation with the Balkans” – ITCB)

The United States Department of Commerce and the General Secretariat for International Economic Relations in the Ministry of National Economy of Greece (hereinafter known as the “Participants”);

*Considering* technology cooperation an important condition for economic stability, peace restoration, and the peaceful transition to free enterprise economies in the Balkan region;

*Recognizing* that working together to foster collaborative and mutually beneficial technology cooperation with countries in the Balkan region will provide economic benefits to the Balkan region and to the United States and Greece;

*Realizing* that expanded international cooperation in technology will strengthen the bonds of friendship and understanding between the United States and Greece, and with the countries of the Balkan region;

*Desiring* to promote collaboration and cooperation among the full array of research, technology and industrial organizations, researchers, and engineers of both Participants for the benefit of the Balkan region; and

*Understanding* that the Balkan region, for the purposes of this Memorandum of Understanding, is to encompass Albania, Bulgaria, Romania, the Former Yugoslav Republic of Macedonia, and any other countries in the region that the Participants may later mutually agree to include [Note: as of August 2003, Serbia and Montenegro have been added to the list];

*Have reached the following understanding to guide their cooperation:*

#### **SECTION I GOALS AND ACTIVITIES**

1. The goal of the Participants in entering into this Memorandum of Understanding is to foster collaboration among public and private entities in the Participants, and public and private entities in the Balkan region, in order to enhance technological capabilities in the Balkan region, enhance the relationship between U.S. and Greek private sector firms and entities in the Balkan region, and promote the development of stable, free market economies in the Balkan region.
2. The Participants may seek to implement their goals through the exchange of ideas, information, skills, and techniques and through the identification of areas of collaboration and technological endeavors of mutual interest.
3. Cooperative activities under this Memorandum of Understanding may include, among others, coordinated and joint research and technology projects, studies, and investigations; joint technological courses, workshops, conferences and symposia; exchanges of science and technology information and

documentation in the context of cooperative activities; exchanges of scientists, specialists, and researchers; exchanges or sharing of equipment or materials; and other forms of scientific and technological cooperation as may be deemed appropriate.

4. Cooperative activities should reflect technological strengths in the United States and Greece, and should be structured to provide an appropriate role for U.S. and Greek private sector and academic organizations.
5. Cooperative activities should seek to include public and private science and technology establishments in the Balkan region and encourage the application and adoption of technology in their relevant entities.

## **SECTION II JOINT COUNCIL**

1. For the purposes of implementing this Memorandum of Understanding, the Participants intend to jointly establish a Joint Science and Technology Cooperation Advisory Council (hereinafter the “Joint Council”). The Joint Council should consist of six members, three to be designated by, and serve at the pleasure, of the General Secretariat for International Economic Relations, Greek Ministry of National Economy, and three to be designated by, and serve at the pleasure, of the U.S. Department of Commerce. Each Participant may designate alternate members.
2. The members of the Joint Council should be broadly representative of U.S. and Greek private sector, academic and government institutions and will be appointed by the two signatories.
3. The Joint Council may be assisted by a Secretariat. Each side may appoint an executive secretary who may assist the members of the Joint Council to carry out their responsibilities. The Greek secretariat may be established in the Thessaloniki Technology Park. The Executive Secretaries may be assisted by one or more individuals.
4. The Joint Council may meet annually, or at other regular intervals as deemed appropriate, alternately in Greece and the United States, and additionally as may be determined by the Participants.
5. The Joint Council should elect two Co-Chairpersons from among its Greek and United States members for a one-year term, which may be extended by unanimous consent.
6. For the purpose of evaluating or implementing specific projects, the Secretariat may as necessary appoint additional members to staff working groups and/or committees.
7. The Joint Council is to act by consensus.

## **SECTION III FUNCTIONS OF THE JOINT COUNCIL**

*To implement this Memorandum of Understanding the Joint Council may:*

1. Recommend to the Participants overall policies under this Memorandum of Understanding;
2. Identify fields and forms of cooperation in accordance with Section I;

3. Review, assess and make specific recommendations concerning cooperative activities;
4. Prepare periodic reports concerning the activities of the Joint Council and cooperative activities undertaken under this Memorandum of Understanding for submission to the Participants; and
5. Undertake such further functions as may appropriately be approved by the Participants.

#### **SECTION IV FUNDING AND LEGAL CONSIDERATIONS**

1. All cooperative activities under this Memorandum of Understanding will be subject to the applicable national laws, regulations, and policies of the Participants and to the availability of personnel and appropriated funds.
2. Each Participant will bear the costs of discharging its responsibilities under this Memorandum of Understanding, including costs of participation in meetings of the Joint Council.

#### **SECTION V ENTRY OF PERSONNEL AND EQUIPMENT**

1. Each Participant should attempt to facilitate entry into and exit from its territory of appropriate personnel and equipment of the other Participant, engaged in or used in projects and programs under this Memorandum of Understanding, subject to its national laws and regulations.
2. Each Participant should facilitate prompt and efficient access of persons of the other Participant, participating in cooperative activities under this Memorandum of Understanding, to its relevant geographic areas, institutions, data, materials, and individual specialists and researchers as needed to carry out those activities, subject to its national laws and regulations.
3. Each Participant should strive to provide duty free entry of materials and equipment provided pursuant to science and technology cooperation provided for under this Memorandum of Understanding to the extent permitted by its national laws and regulations.

#### **SECTION VI ENTRY INTO FORCE, TERMINATION AND DISPUTE SETTLEMENT**

1. Activities under this Memorandum of Understanding will commence on the date of final signature and will continue for five years. They may be continued for additional periods of five years upon concurrence of the Participants.
2. Activities under this Memorandum of Understanding may terminate it at any time upon 60 days written notice from one Participant to the other. The expiration or termination of this Memorandum of Understanding will not affect the validity or duration of any arrangements made under it.
3. All questions or disputes related to the interpretation or implementation of this Memorandum of Understanding will be settled by mutual consent of the Parties.

## SECTION VII

The memorandum of understanding has been signed in two copies, one English and one Greek, each copy being equally authentic.

\_\_\_\_\_  
Name:

Date:

**WILLIAM DALEY  
SECRETARY  
UNITED STATES  
DEPARTMENT OF COMMERCE**

\_\_\_\_\_  
Name:

Date:

**YANNOS PAPANDONIOU  
MINISTER  
MINISTRY OF NATIONAL  
ECONOMY AND MINISTRY OF  
FINANCE OF THE HELLENIC  
REPUBLIC**

**Original certified by Suzanne P. Payne, Consul of the United States of America, U.S. Embassy, Athens, Greece 20 January 1998.**



## **APPENDIX B: Biosketches of the ITCB Members**

### **US Members and Alternates**

#### **Constantine Aloupis**

Constantine Aloupis is the President & Managing Director of Motorola A.E and also Corporate Director for Southeastern Europe, based in Athens. Previously, he was the Corporate Director of Worldwide Customer Network Services for the Information Systems Group in Motorola, U.S.A. Mr. Aloupis serves as Vice Chairman of the US-Greece Business Council, is a member of the Board of Directors of the Greek-American Chamber of Commerce and has served as a member of the Board of Directors of the Greek C.E.O. Association.

Since 1973 and before joining Motorola in 1992, Mr. Aloupis held several senior management positions with Digital Equipment Corporation in both U.S. and International locations. In 1987, he returned in Greece as Vice President and Managing Director of Digital Equipment Hellas. Mr. Aloupis graduated from the Athens Varvakios School in 1964, and he holds degrees in Electrical Engineering, Computer Science, and Business Administration. He is a graduate of the University of New Hampshire, the University of Connecticut, and Harvard University.

#### **Nicholas A. Ashford, ITCB Co-chair**

Nicholas A. Ashford is Professor of Technology and Policy at the Massachusetts Institute of Technology, where he teaches courses in *Environmental Law and Policy*, *Law, Technology, Law and Public Policy*, and *Sustainability, Trade and Environment*. Dr. Ashford is a Faculty Associate of the Center for Technology, Policy and Industrial Development in the School of Engineering; the Institute for Work and Employment Research in the Sloan School of Management; and the Environmental Policy Group in the Urban Studies Department. He holds both a Ph.D. in Chemistry and a Law Degree from the University of Chicago, where he also received graduate education in Economics. Dr. Ashford also holds adjunct faculty positions at the Harvard and Boston University Schools of Public Health.

Dr. Ashford was a public member and chairman of the National Advisory Committee on Occupational Safety & Health, served on the EPA Science Advisory Board, and was chairman of the Committee on Technology Innovation & Economics of the EPA National Advisory Council for Environmental Policy and Technology. Dr. Ashford is a Fellow of the American Association for the Advancement of Science and chair of its Section on Societal Impacts of Science and Engineering. Dr. Ashford's research activities include work for the United Nations Environment Programme, the OECD, and the European Union, as well as for U.S. regulatory agencies and the U.S. Office of Technology Assessment. He serves as an advisor to the United Nations Environment Programme and is also legislation, regulation, and policy editor of the *Journal of Cleaner Production*.

#### **Haris Doumanides**

Prof. Charalabos (Haris) Doumanidis holds his Diploma in Mechanical Engineering from the Aristotelian Univ. of Thessaloniki (1983), his M.S. from Northwestern University (1985), and his Ph.D. from MIT (1988). He has been a Postdoctoral Associate with the MIT Laboratory for Manufacturing and Productivity (1989), a Squadron Sergeant for the Hellenic Air Force (1990), and a Lecturer at the Aristotelian Univ. (1991). He is a Professor of Mechanical Engineering and

Director of the *Hephaistos Thermal Manufacturing Laboratory* at Tufts University in Medford, Massachusetts since 1991; Chief Scientist with Axcelis Technologies (Thermal Processing Systems) in Beverly, Massachusetts since 2000; the founding Director of the *Nanomanufacturing Program* at the National Science Foundation (NSF) in Arlington, Virginia since 2001; Visiting Professor of Mechanical Engineering at MIT since 2002; and a consultant for automation, optoelectronics, biomedical imaging and automotive industries. His research and teaching interests include thermal manufacturing, material deposition and joining processes, rapid prototyping, rapid thermal processing and laser annealing of semiconductors, distributed parameter system modeling and control, robotics and mechatronics, and biomedical instrumentation. He is an Associate Editor of the *International Journal of Modeling and Simulation*, the organizer and chair of several symposia for ASME, IASTED, IEEE, NSET and NSF, the speaker of keynote and invited lectures, and the author of over 150 papers and several patents and book chapters. He is the recipient of the ASME *Blackall Award* (2002), the White House *Presidential Faculty Fellow Award* (1996), the NSF *Young Investigator* (1994) and the *Research Initiation Award* (1992), as well as several grants from NSF, SME, DOE, NIST, Honda R&D Americas etc. He presently serves as Professor of Mechanical & Manufacturing Engineering at the University of Cyprus.

### **Panos Hadjimitsos**

Panos Hadjimitsos is the Electronics and Computer Technology Program Director at DeVry University. DeVry University offers undergraduate and graduate studies in business, management, and technology and has more than 60,000 students in 25 campuses across North America. DeVry recently acquired Ross University Medical School. Mr. Hadjimitsos coordinates the delivery and facilitates the future direction of the ECT program.

Prior to joining DeVry University, Mr. Hadjimitsos worked for multinational companies, including Matsushita, Baxter, and Knowles Electronics. Mr. Hadjimitsos worked in systems development and deployment, critically contributed to the successful launch of four product lines, founded AutoMed Technologies (ATi), assembled and guided the product promotion and distribution efforts for overseas manufacturers of medical equipment, and coordinated the technology transfer from R&D to manufacturing.

Mr. Hadjimitsos completed his high school studies at Anatolia College, Thessaloniki, Greece, his Baccalaureate in Electrical Engineering at Pratt Institute, New York, and his Master's in Electrical Engineering at the University of Illinois, Urbana-Champaign. He has volunteered his time for the development and maintenance of Web sites for cultural and educational groups and is an evaluator for the Technical Accreditation Committee of ABET (Accreditation Board for Engineering and Technology).

### **John Sitolides**

John Sitolides is Executive Director of the Western Policy Center, a public policy organization promoting U.S. geostrategic interests and Western institutions in southeastern Europe, emphasizing Greek-Turkish security cooperation and Balkan political and economic integration into Western and international frameworks. Mr. Sitolides directs all aspects of policy, strategy, communications, and development for the Center, which focuses its activities on the National Security Council, the State Department, and the Defense Department, as well as international affairs organizations, foreign governments and embassies, Congress, U.S. and foreign media,

and the private sector. He founded the Western Policy Center's Washington, D.C. operations in March 1998.

Mr. Sitalides has testified before Congress on U.S. foreign policy in southeastern Europe. He is recognized by the State Department's Foreign Service Institute as a subject matter expert on American Foreign Policy Process, and is a regular lecturer on U.S. foreign policy at the National Foreign Affairs Training Center. He has also lectured on U.S. foreign policy at the National Defense University, Yale University, George Mason University, the University of Texas School of Law, and the Graduate Center - City University of New York. A frequent panelist at international relations conferences and roundtables, Mr. Sitalides is a member of the Foreign Policy Association, the World Affairs Council of Washington, D.C., and the Academy of Political Science, and is listed in Who's Who in America. He received his Master's Degree in International and Public Affairs at Columbia University in 1986, with specialization in International Security Policy, International Political Economy, and Western European Affairs, and his Bachelor's Degree in Political Science from Queens College in 1983.

### **Manuel Stefanakis**

Manuel Stefanakis directs Sustainable Strategies International, a consultancy that promotes responsible economic development that is environmentally, socially, and economically integrated and balanced. Over a 30 year period, his experience has been in developing strategies for and management of large-scale developments, public policy reforms, institutional and capacity building, and teaching. He has been engaged in more than 30 countries, including southeastern Europe, the Middle East, the Mediterranean, former Soviet Union, Asia, and Latin America. He has worked with international development agencies (USAID, World Bank, EBRD), multinational corporations, international consultants (Arthur D. Little Inc.) and international NGOs. Among his assignments, he served as the Resident Director of a USAID-funded program in the Czech and Slovak Republics to promote environmental quality through market based tools, as an advisor to the EBRD for programs throughout the former Soviet Union, as an expert to the UN in Bahrain.

He currently serves as the special advisor to the governor of the State of Oaxaca, Mexico in sustainable development. He also serves on the board of directors to the Global Institute at Tufts University, the City of Cambridge Climate Change Advisory Committee. He has been an active member of the Orthodox Patriarchate's initiatives on religion and environment. He has recently been engaged by USAID to strategize and implement a new initiative that promotes public private partnerships in the Asia/Near east region.

Mr. Stefanakis has earned professional degrees from Harvard and the University of Pennsylvania (Philadelphia) and an undergraduate degree from the University of Massachusetts at Amherst. He lives in Cambridge, Massachusetts.

### **Greek Members and Alternates**

#### **Professor George Chryssolouris, ITCB Co-chair**

George Chryssolouris is Professor (1993-) and Chairman of the Department of Mechanical Engineering and Aeronautics at the University of Patras, Greece. He is also the Director of the Laboratory for Manufacturing Systems and Automation (LMS). LMS has about 70 researchers working on a variety of research subjects including production systems planning and control,

software development for industrial networking, innovative manufacturing processes, virtual reality engineering applications, and quality control and metrology. Professor Chryssolouris was Chief Executive Officer of OTE, the national Greek telecom operator, and member of its board of directors (1996-1999). Under his leadership OTE, the largest company of Greece with 20000 employees and annual revenue of ca. \$3 billion, became the first Greek company to be listed in the NYSE (New York Stock Exchange). Professor Chryssolouris was also advisor to the Prime Minister of Greece on education and technology (1996-1998).

Professor Chryssolouris worked at MIT (Massachusetts Institute of Technology) in the USA between 1980-1993. He led a research group for the development of information systems and automation for industrial applications. He taught at MIT undergraduate and graduate level subjects related to manufacturing, systems, design and automation. Between 1980 and 1993 he served also as Vice-President, responsible for the US operation, of a German engineering company specialised in industrial automation. In 1988 he established, with help from venture capital, a company for marketing software products developed by his research group at MIT. He worked (1976-1980) as Research Associate in the Institute of Manufacturing Technology and Machine Tools at the University of Hanover, Germany. Professor Chryssolouris has more than 200 publications in international scientific journals and refereed conferences. He is the author of two books published by Springer Verlag. He holds a US Patent for a laser machine design and he was the recipient of SME/s Young Outstanding Manufacturing Engineer Award (1986). He was also granted the Frederick W. Taylor Research Medal by SME (2001) for his outstanding contributions to manufacturing research. He received a Ph.D. (Dr.-Ing.) in Engineering from the University of Hanover, Germany (1979) and a Diploma (M.S.) in Mechanical/Electrical Engineering from the National Technical University of Athens, Greece (1975).

### **Professor Ioannis Kontoleon**

Ioannis Kontoleon is a professor in the Department of Electrical and Computer Engineering, Aristotle University of Thessaloniki. Professor Kontoleon obtained his Degree in Physics from the University of Athens (Greece) and his PhD in Electrical Engineering and Electronics from the University of Liverpool (U.K). During 1968-69, he was with the Dept. of Electronics at the Nuclear Research Centre, in Athens and from 1969 to 1971 he was cooperating with the National Centre of Systems Reliability (U.K.A.E.A), on the “Reliability Analysis of Electronic Protective Systems”, for Nuclear Reactors. From 1972-1974 he was with the Research Group of the Research Directorate of the Hellenic Telecommunications Organisation and from 1974-1981 he was a member of academic staff in the Department of Electrical Engineering, the University of Wollongong (Australia). He has served for many years as a member of the Executive Committee at the International Centre of Technical Co-operation (ITCC), and as a member of the Executive Committee in ESRA (European Safety & Reliability Association). He is a member of the Editorial Board of the “*International Journal of Reliability Management*” and of the “*Facta Universitatis*”. He is the author of over 60 research papers in international research journals. His primary research interests include reliability modeling and optimisation of networks and systems and fault tolerant system design.

**Professor Pantelis Lazaridis**, Rector, University of Thessaly. [Biography being updated]

## **Professor Vasilios Papageorgiou**

Vassilios P. Papageorgiou is currently Head of the Chemical Engineering Department at the Aristotle University of Thessaloniki. He has also been elected Dean of the School of Engineering for two periods of three years duration. He received his Ph.D. and D.Sc. degree from the Aristotle University of Thessaloniki, with his research focusing on the isolation and structure elucidation of wound-healing agents of plant origin. After postdoctoral work at the Pharmacy School, University of Kentucky, he was elected Professor of Organic Chemistry.

He has published more than a hundred research papers and is the holder of several patents. He has been research associate of the American Research Institute, Research Corporation and is a member of several professional associations. In 1983, he was elected a member of the New York Academy of Sciences. He has also been member of the National Drugs Organization (EOF) and serves as a member of the Organizing Committee of the Ministry of National Economy for the coordination of the Greek participation in the World Exhibition, EXPO2000, held in Hanover.

## **Professor Christos Zerefos**

Christos S. Zerefos is a Professor in the Department of Physics, University of Athens. He graduated in Physics from the University of Athens, from which he also obtained an MSc in Meteorology and a Ph.D. in Physics-Meteorology. He formerly worked as a post Doctoral researcher at the National Center for Atmospheric Research (NCAR), USA, the National Hellenic Research Foundation, Greece and the Academy of Athens. He is a member or fellow of several scientific societies including the American Meteorological Society, the Royal Meteorological Society, the American Geophysical Union, several scientific societies in Greece and non-governmental organizations including Greenpeace. He is also the Vice President of the Mariolopoulos-Kanaginis Foundation for Environmental Sciences and Advisor at the Ministerial level for ozone and UV-B issues, as well as a member of the European Commission Stratospheric Science Panel of Experts. He has been elected to serve for three terms as a member of the International Ozone Commission and he is a member of the Greek IGBP Committee of the Academy of Athens. In 2000 he was elected a member of the New York Academy of Sciences and in 2002 he was elected a member of the EU Advisory Board for DGXII.

Professor C. Zerefos coordinated or participated in more than 35 large international research competitive projects, funded by International Organizations and the European Commission. He has presented more than 190 original papers at international meetings and has published more than 135 original research papers in refereed journals. He has been awarded the Embirikeion Award for the Advancement of Science (1979) and was a Fulbright Scholar (1985). On the occasion of the 10<sup>th</sup> anniversary of the Montreal Protocol he was awarded the Global Ozone Award from the United Nations Environmental Program (1997). Since November 2002, he is has served as a member of the Strategy Group for Environment of the European Academies Science Advisory Council (EASAC), and since 1992 he served as Director of the Balkan Environmental Research and Development Institute (BERDI).

## **APPENDIX C: Studies on Agriculture**

# AGRICULTURE

The sub sectors included in the sector are plant growing, livestock, forestry and fisheries while the broader cluster includes the production of machinery and equipment, veterinary sector, pesticides and fertilizers producers, agricultural products processing sector as well as the biotechnology sector that is focusing in agriculture.

## A. BULGARIA

Agriculture is a very important sector in Bulgarian economy participating in 13% of the GNP and employing 25% of the country labor force (in contrast with EU average of 5%). Following the transition process the sector experienced significant changes connected with land privatization and the general economic problems of the country that decreased the levels of production and the productivity of the sector.

Another important – critical characteristic of the sector - is the land fragmentation, that is limiting efficiency and ability to use more advanced production techniques. Only 0.2% of the total holdings have a size greater than 10%, covering 30% of the total arable land.

The study grades the overall cooperation perspectives of the sector as **medium to high** based on the present low level of technology, the expected growth of the sector that will push for significant upgrading of the sector technological level and the relatively strong agricultural research potential of the country.

### **1. What is the technology status of the sector**

The sector analysis revealed significant information about each sub sector and the present status of available-used technology.

**Plant growing – Arable land accounts for 4.2 million hectares (of which 700,000 is not cultivated). The most important crops cultivated are cereals (wheat, maize, barley) and sunflower. Tobacco and vegetables are also produced in significant volumes. Plant production has decreased significantly during the transition years following land segmentation, economic stagnation and outdated or inappropriate or production processes.**

- **Production equipment:** Mostly simple, conventional Bulgarian equipment. Few secondary processing companies use more advanced imported equipment.
- **Storage equipment:** There is a very limited number of storage facilities and producers have to sell their production directly after harvest. The existing storage facilities use basic temperature control equipment.
- **Raw material handling:** Only primary treatment, no sophisticated raw material secondary processing and some basic soil preparation techniques.
- **Irrigation:** The condition of the irrigation system of the country is poor, 80% of the canal system is not working (in 97 only 50,000ha of the total arable land were irrigated). Utilized irrigation methods include spraying (mostly used), gravitation irrigation (less) and spotted-dropped irrigation (very limited) using of domestic produced equipment.
- **Farming:** Mainly manual collection or use of tractors of small power for various farming tasks. The average horse power in Bulgaria is 50hp/hectare compared to 300 in EU. Existing tractors and combine harvesters are in general old (more than 10 years) and in many cases practically non-operational.

- **Fertilizers**: The use of fertilizers decreased significantly during the transition years due to high costs and decrease of demand that also affected the fertilizer producing industry. Most international companies that produce fertilizers are present through distributors and some of them provide also technical assistance. All basic fertilizers and plant protection substances are imported in the country. Fertilizer production in the country decreased significantly during the transition period, not supported from adequate demand in the domestic market.
- **Pesticides**: Standard conventional technologies used domestically produced or imported.
- **Biotechnology**: Biotechnology is used for seeds preparation, disinfection of soil and hybridization. Although there is significant research activity in Bulgaria, technologies and methodologies are mostly imported.
- **Greenhouses**- The conventional greenhouse facilities are used from a small number of agriculture companies.
- **Seeds**: At this point there is significant local production of seeds that covers the demand (national seed gene bank). However, seeds provided are not of high quality that and are mainly imported when financial resources are available.

A particularly important sub sector of agriculture is grape production, almost exclusively directed to the production of wines. Around 60.000 hectares are presently cultivated and in general the sector is facing a decline. The main problem is the age of the vineyards (many over 25 years), their poor maintenance and the lack of funding resources for replacement. There is a big number of varieties (over 20) cultivated in the country.

**Livestock - The privatization process during the transition period resulted in significant reduction (more than 50%) of the total livestock due to lack of resources and inexperience of farmers. Pig production followed by poultry are the most important sub sectors. In terms of present technology it is mostly outdated.**

- **Stock breeding facilities**: Mostly old technologies (more than 5 years or even 10) used for milking, feeding, cleaning and waste treatment.
- **Fodder**: Both production and mixing technologies are simple and of domestic origin.

**Fisheries – The fishery sector is small (less than 0.14% of GDP) but important for specific remote areas along the Danube and the Black sea. It includes both coastal fishing in the Black sea, inland fishing, fish farming and aquaculture (carp, rainbow trout, mussels) and high seas fishery. 7000 tones is the annual fresh water fisheries production. During the transition years there were significant declines in production and demand and at the same time significant part of infrastructure became obsolete. The majority of vessels are small and old. The aquaculture sector is using intensive and semi-intensive polyculture techniques but it is suffering from extremely low margin profits, low domestic demand and low penetration of EU markets. Juveniles are provided domestically from the Freshwater Fisheries Institute. Another problem is the low quality of the feed.**

**Forestry – Forest planning is a significant economic activity and it is also playing significant role in the erosion problem reduction. Forests and woodland account**



**for 34% of the country total area (34.9 million ha). The main products from forestry are sawn wood, wood-based panels, wood pulp and paper and paperboard.**

## **2. What are the technology needs and opportunities of the sector?**

Based on the increased importance of agriculture in the Bulgarian economy and the forthcoming integration of the Bulgarian in the EU, there are significant needs for modernization of the Bulgarian agriculture sector, application of new technologies for plant growing, collection and second level processing, for new seeds and varieties of products and modern irrigation techniques. In addition there is need for use of IT technologies especially concerning the promotion of products in the international market (internet marketplaces).

The studies revealed in more details some of these issues by sub sector and type of activity. In general there was increased demand for more of those types of already used equipment that goes along with the need for more intensive production methods and increase of production capabilities. More specifically:

**Plant growing - The main horizontal issues concerning the sector are connected with the small size of farms that limit the efficiency for new production technologies and also the financial resources of farmers. In addition, the existing irrigation system is not working (only 40% with low performance).**

- **Raw materials** - Increased demand for soil processing preparation processes
- **Production technologies** – There is demand for new and upgraded equipment for the full activity range in the production process.
- **Storage** – There is significant need for new modern storage facilities and methodologies such as freezing, ventilation and fruit ripening.
- **Irrigation** –As mentioned earlier, significant investments are necessary in order to upgrade the irrigation network of the country and increase the percentage of irrigated land. Concerning irrigation methods in farms, besides the conventional methods for irrigation that are still in high demand there is need for more modern irrigation methods and equipment such as underground irrigation, water level control, hydroponics.
- **Farming machinery equipment** – The agriculture sector is in need for significant upgrade and replacement of the old tractors, harvesting and other farming equipment. The projections of the Ministry of Agriculture and Forestry for the following 5 years are for 400million EUROS expenditure in new harvesters, tractors and trailing equipment.
- **Fertilizers** – Demand is increased for already existing technologies and it is mostly associated with the need for more use of fertilizers.
- **Greenhouse** – Significant reference is done to the need for new greenhouse related technologies in the following areas: Microclimate control systems, CO2 gas generators, solar radiation control systems, polycarbonate covers.
- **Biotechnology**– Need for more extensive use of present biotechnology methods and products.
- **Seeds** – Continuous and growing demand for improved seedling production technologies.

## **Livestock – Need/demand is expressed for**

- **Fodder** - Demand for fodder mixing and dosage control equipment.

- Stockbreeding facilities – Demand for upgrading and expansion of the existing stockbreeding facilities is great but not so much for new technologies. However, the age existing equipment should be considered a reason for change.
- Upgrading and investments to reach EU hygiene standards

**Fisheries – The fishery sector is in need for investment -modernization in all activity areas concerning the fishing process and fish farming as well as processing, packaging and promotion of the products. Specifically:**

- Need for new vessels
- Need for facilities for first sale services, distribution network and inland wholesale facilities.
- Hygiene standards and quality standards and health control in fish farms (HACCP)

**Forestry – The main issues facing the forestry sector are the small wood-paper processing capacity.**

**Opportunities-** Beyond the investment and technology transfer opportunities that arise from the needs of the agriculture sector, there are also specific areas that are expected to grow and require significant technology support. These are the ecological (bio) products sector and the genetically engineered products. In both sectors at this point there are significant needs for investment in basic and enabling technologies.

In addition it should be pointed out the necessity for improvement in the area of quality control and assurance in all sub sectors that will provide entrance to the Western Europe markets where standards are higher at this point. Finally, facilities-technology for solid waste treatment, especially from livestock and fisheries sub sectors are necessary.

**Business needs –** A number of horizontal needs-issues were also raised:

- Almost all sub sectors express need for automatization of production and utilization of IT.
- There is intention for vertical integration towards good processing.
- Improvements in logistics and supply chain management are considered necessary since at this point there are significant problems concerning transportation and storage

**3. What is the capacity of the sector for innovation**

**Support structure** - There is a number of support services in the agriculture sector. The National Agricultural Advisory System offers consulting in the areas of plant growing, irrigation and plant protection and has created agribusiness, training centers as well as a lab for agro-chemistry. The network of NAAS has been extended to most areas of the country and it has been upgraded in terms of physical and human capital through PHARE support.

Concerning agricultural education – a very critical parameter for the promotion of new technologies- 12% of the students of at this point attend agricultural, forestry and food colleges and technical schools. Around 1/3 of these are the student moving into higher education in the 5 agriculture related universities.

Concerning the research capacity of the country, there are 66 research institutions spread in the country covering most of the agriculture relevant issues (from plant growing, protection, machinery, farm management, veterinary, disease control, fisheries, forestry, livestock). The level of research is significant as well as the existing technical knowledge, however the problem

of funding for research is critical. Research in crops genetic resources is significant and the relevant research centers and institutions are participating in international programs. Results of this research are used in an extend from the industry and there is potential for greater cooperation.

The research activity is disseminated through the 9 national journals covering most areas of the sector. In the fisheries sector research is conducted on genetics, selection, feeding, and trout and carp diseases as well as on the quantity and density of fish populations in the Black Sea.

At the same time there is significant information concerning agricultural business, technology and equipment offers and other relevant services in the web revealing a base for further development and progress in this area. A number of Bulgarian enterprises are connected with international companies and import machinery, equipment and raw material.

The very critical services of quality control for seed, plant protection, and veterinary are also available but there is expressed need for improvement. At this point there are 106 district veterinary services and 33 border ones, supported from 1 central research and diagnostic institute, 4 regional institutes and 17 laboratories. However, there is need for computerization of this network to improve its operation and effectiveness. In addition, the technical inspectorate is conducting testing and organizes inspections of machinery and equipment offered in the country and provides quality certificates.

**Government support** – The government pays increased attention to the development of the sector as a very critical to the economy and an employer of 27% of Bulgarians. The government has set a number of support programs funded to support new agriculture business, the production of eco-friendly production, introduction of modern equipment and farming/growing techniques and the young farmers. Duty free imports of equipment and machinery were also used to support modernization of equipment. At the same time, SAPARD and PHARE EU support programs provide additional funding for various restructure and agriculture development programs. However, funding resources are not generally available for producers and bank credit is significantly limited despite increasing demand. Concerning fisheries significant attempt has been made in an attempt to improve the gene pool in fish farms.

Another parameter is that there is still lack of experience and expertise in the national and local administration for the more successful implementation of agriculture policies.

**Related sectors** - Local machinery production covers 4% of the total market mainly in the small tractors segment, while bigger tractors and combines are imported. International producers are present in the market and the limiting factor is the availability of funds for equipment purchase. Fertilizers and plant protection chemical productions have dropped considerably since 1989. The use of these inputs also declined drastically in the same period due to a generalized lack of finance, decrease of demand and increase of price after the abolishment of state controls. On the downstream size, the food industry is quite developed in the country and in many sectors agriculture production cannot satisfy demand for raw material from the food sector.

**Demand** – Demand for higher quantities and quality of agriculture production is connected with the food industry sector. There is ample space and opportunity in this area. On the other side the low purchasing power of the population does not –at least at this point – give prospects for higher-value products in the domestic market. Especially in the fisheries sector consumption is much bellow EU standards and demand for high-value products is still limited.

#### **4. What is the legal framework**

**Responsible authority** - The ministry of Agriculture and Forestry is responsible for legislation and policies concerning the sector. Under its supervision a number of specialized agencies cover the whole range of related sub areas.

There is a number of issues concerning the supporting legal framework for the development of the sector. In almost areas EU accession is the driving force although in some areas Bulgarian is far behind full harmonization.

- The legal framework for the consolidation of the fragmented land has been created and it is expected to improve the structure of the industry, its effectiveness and its ability to follow the technology developments.
- The government has liberalized the market and the level of protection is lower than EU CAP and have removed all types of licensing requirements for importing and exporting. Seed controls have been eliminated and the European catalogue of seeds has been adopted.
- The tobacco sector is the only sector that is still under extensive support with the provision of premiums and tobacco seeds for free.
- Another important issue that is affecting the sector is the environmental issues and the significant pressure posed from the agricultural production. The government has set a number of initiatives that aim to support organic production, endangered species and crops production maintenance.
- In the veterinary control sector a range of control legislations exist but the problem is in the enforcement and supervision, especially since Bulgaria is bordering with countries of lower standards.
- Concerning fisheries, following EU accession requirements, a new legal framework is set in an attempt to create a market driven sector, protect the environment and create the base for a sustainable growth of the sector.
- Concerning use of genetically modified organisms, Bulgaria has been for quite some time the playing-field for genetic engineering experimentations from multinationals and the responsible authority (National Council for Biosafety) that gave permissions for use of GMOs was not very strict. However, EU accession will bring revision of legislation and impose stronger standards for

#### **5. What are the needs for innovation training of the sector**

The study reveals needs for training of the rural population in the use of new technologies. The high demand for conventional (familiar) technologies illustrates that there is decreased awareness of the new available methods that could improve productivity of land. In addition, it is necessary that the marketing and management skills of agriculture companies in all relevant sub sectors are increased since exports are very important for the future growth of the sector.

#### **6. Next Steps for ITCB**

Actions that could be taken from ITCB, responding to the issues raised in the study are:

- Evaluate the research capacity of the big number of research centers in the country and propose research cooperation in programs focusing in seed and food quality as well as new farming and plant growing techniques.
- Organize/support training events and workshops for advanced agriculture production methodologies.

- Research projects and cooperation with the respective research centers in Bulgaria in the area of veterinary control and disease inspection and diagnosis using modern techniques and technologies.
- Promote brokerage events for machinery and equipment.

## B. FYROM

The sector is characterized as one of **high priority** for technological cooperation given the level of mechanization of the sector, the presence of a relatively strong food industry that is expected to increase demand in the future and the need for the country to keep in pace with technological developments in order to maintain competitiveness.

### **1. What is the status of the sector**

The technology status of the country is higher than the other Balkan countries and agriculture activity is relatively modernized. Agriculture has a share of 12% of GDP and the sector represents 20% of exporting activity and employs around 18% of the labor force.

**Plant growing** – The main products are wheat, barley, fodder crops (pea and alfalfa), sunflower and greenhouse tomato. The total land arable land used is 660,000 hectares of which around 4% is vineyards. 80% of the land is in private hands and the remaining is socially owned lands (agrikombinats). The average land size is around 2.5-3 hectares.

In general the sub sector is quite modernized – in comparison with the other Balkan countries. Farmers use most of the conventional agriculture methodologies such as fertilizers, pesticides and use purchased seed, and agriculture enterprises are using production equipment in all stages of production. Around 1/6 of the land is irrigated - the most common irrigation methods used are furrows, sprinklers and drip irrigation. 55% of the farmers have some type of tractor and there is an established machinery rental market. At this point the ratio of hectares to tractors for the private owned land is around 3.5 hectares/tractor. Greenhouses and biotechnology methods are also mentioned as being used by some agriculture companies. In general, we could say that a mixture of old and modern technologies and methods being used in the sector.

**Livestock**- Livestock production is mainly cow milk and lamb meat. Sheep production is rather low but is very important from the economic point of view, due to the export orientation of the lamb production (roughly 2 000 000 tonnes of lamb meat is marketed on markets of the EU). On the other hand, sheep cheese is marketed locally, and it meets the demand for this product. The main support for livestock production is based on the quality of pasture land and the presence of fodder production factories with a significant capacity.

Sheep feed and nutritional regimens are closely related to the limited opportunities of the farmers for forage production, as well as their financial capacity for partial grain supply (barley and feed meals for lambs). In most cases, ewes are fed below requirements. The annual energy requirements are partly met by pasture grazing, but half of it should be provided by feeding the animals on farms. Productivity in terms of meat, milk and wool production in comparison to EU standards is still very low.

**Forestry** – The sector is not developed and domestic production is very limited. Primary use of wood is for fuel and wood processing is very limited in local sawmills producing mainly wood-based panels.

### **2. What are the technology issues and needs**

The sector is already using conventional agriculture methodologies. Need is expressed for new modern technologies to increase productivity. Particular interest is expressed for:

- Warehouse /storage facilities
- New advanced packaging technologies for agricultural products

- automatization technologies,
- quality control and assurance systems
- greenhouse facilities.

In addition there is increased expressed interest from companies for IT applications in the sector, varying from basic PC and network provision, to advanced resources management applications. The problem of land erosion is also highlighted and there is for new irrigation methodologies.

### **3. What is the capacity for innovation**

**Support structure-** The country is showing significant effort to support the agriculture sector and to create the necessary structure and supporting services to promote the use of new production methodologies, improved production processes.

The Agency of Motivating the Development of Agriculture is one such attempt providing various types of services to farmers (training, production consulting, market information, new species promotion) through 6 regional centers.

In addition there are 6 research institutes covering some parts of the agriculture sector and 2 university departments (agriculture science in St Cyril and Methodius in Skopje and St. Clement in Bitola). More specifically the related research centers/labs are:

- Institute of agriculture
- Institute of rice
- Institute of south-agricultures
- Veterinary institute
- Institute of animal science
- Research center for genetic engineering and biotechnology

As such, the sector is the most research-supported sector in the country. However, there is no available information on the research capacity of these institutions. Concerning human capital, there are about 2,000 specialists with university or college qualifications and about the same number of agricultural technicians. About 120 doctors of agricultural sciences are involved in scientific, scholarly, research, educational and production activities in this field.

**Firm strategy** - The studies revealed that the agriculture companies are using research results and cooperation programs for productivity improvement and in general there is a positive attitude towards new technology. A very interesting initiative in an attempt to increase quality of products and marketability is the seal of quality provided to meat and dairy products that follow EU standards and was built around the livestock sector and meat and dairy processing. It has resulted in significant improvements in quality and marketability of products.

**Related industries** - Concerning the presence of supporting-relevant industries (machinery, fertilizers, seeds, etc), there is no domestic production but a relatively extended network of importers and retailers (a big share of this activity from the big socially owned enterprises which are vertically integrated) that provides such inputs.

**Demand** – The local market is small and population purchasing power cannot create significant demand for advanced quality products. On the other side, a relatively strong food processing industry with exporting activity needs higher quality and more raw material presenting opportunities for development.

**Government support-** The government is providing support through the Extension services of the Ministry of Agriculture, that focus on technical services, provision of experimental seeds and pest control advice. There is also subsidy provision for innovations in agriculture production. In all the municipalities of the Republic there are active centers for the promotion of individual agriculture.

The World Bank project in FYROM is focusing in the rehabilitation of the irrigation system and to support private farmers to modernize their production methods, support agriculture research, develop information services, improve the capacity of trainers and advisors in the country and increase access to credit. World Bank support is available contingent on implementation of measures moving further to reduction price premiums and subsidies and creation of a fully operating market.

#### **4.What is the legal framework**

Concerning the legal framework, a new law concerning agricultural land –created with the support of EU- is established. Privatization of the land has not been completed yet and the government is now in the process of privatizing most of the agro-kombinats. Import restrictions were mentioned as a barrier for acquiring specific inputs.

#### **5. What are the needs for innovation training**

Given the demand for update and the general awareness of new technologies, it is necessary that training is directed towards :

- modern land cultivation techniques
- stockbreeding
- training in proper use of new technologies and technology management in order to sustain growth of the sector

#### **6. Next steps for ITCB**

There is important information missing concerning the status of the sector, especially since the overall assessment is that the sector is one of high priority. Still we could say that the report points out towards specific priorities:

- Assess the research capacity of the existing institutions and the areas of expertise in order to promote joint research projects.
- Support new technology training conferences, workshops following the expressed demand by the companies in the sector.
- Focus on modern irrigation techniques and methodologies promotion. Support similar projects such as the precision agriculture.
- Given the high potential of the sector, it is necessary that more concrete information be collected in an attempt to draw the complete picture of competitiveness diamond of the sector.



## C. ALBANIA

The studies ranks the agricultural sector as one of **high priority** based on the fact the agriculture activities capture more than 50% of the country GDP, the very low level of available technology, the existing trading partnerships of the Greek and US agricultural sectors.

### **1. What is the technology status of the sector**

**Plant growing** - The main products of Albanian agriculture sector are wheat, maize, potatoes, vegetables and forage for livestock feed. The existing level of technology is very low in almost all establishments. The average land size is 1.1 hectare, following the privatization and distribution of the land that transformed the big state farms to small family farms. At this point the production covers no more than 50% of local demand and it is much lower levels that the 70s period. Another characteristic of the agriculture production is that a very big number of farmers produce for family-consumption or sale only the surpluses. Only a small share (15%) produces mainly for sale.

Only 2% of farmers own a tractor and every 500 farms have a harvest combine. Other type of specialized equipment is very limited and various other tasks are performed manually or with the use animals. Fertilizers and seed from private dealers are sold to 70-75% of farmers.

The irrigation system covers around 45% of arable land and farmers used basically only surface irrigation (furrows and strip-type) and only few large plots use sprinklers. During the socialist regime heavy investment was directed towards irrigation systems. However, it became obsolete or non-operational during the period of the change.

**Livestock:** Livestock production accounts for more than 50% of the present agriculture sector product. The main livestock products are poultry –directed mostly towards egg production rather than meat, cattle –mainly for dairy products- and sheep and goats. Herds are very small – family owned, management techniques are outdated and animal housing and hygiene are sub-standard. All these parameters lead to low production levels (e.g. milk per cow production 1700 lt/year in comparison to 3500 in Bulgaria).

**Fisheries-** The total vessel fleet is 200 very old (most around 30 years) vessels, mainly trawlers and gill-netters. 62% of the activity is directed towards trawl fishing. Concerning aquaculture, there is complete unawareness of modern aquaculture methods and technologies.

**Forestry** – Forestry is not developed in Albania. Woodcutting had been quite extensive during the last years after 1990 but was almost exclusively directed for fuel. Another interesting activity is the herbs and aromatic production.

### **2. What are the technology needs of Albania**

**Plant growing** - The most urgent and critical need for Albanian agricultural is for agriculture machinery in all segments of the process as well as for new better quality seed varieties. There is also need for improvement of the irrigation system and there is ample space for application of new more efficient irrigation technologies, the limiting factor being the availability of funds. The small number of agriculture companies express need for storing and packaging and basic processing (cleaning).

**Livestock:** The major needs for the sector is for better feeding as well as for drugs, vaccines and improved veterinary control to improve health protection and increase dairy products levels. In addition, there is need for modernization of housing facilities and

improvement of management techniques. The few existing big companies are also asking for quality control and assurance systems, that will improve exportability of production.

**Fisheries:** There is need for substitution of the very old vessels as well as for the creation of facilities for first sale and an inland distribution network. In addition, high demand is present for introduction of new aquaculture methodologies and adoption of specific fish cultivations (e.g. Koran)

### **3. What is the innovation capacity of the sector**

**Support structure** - The quality of agriculture labor is in general low. Only 2 percent has attended higher education institutes and 21% attended high school. In general the skills of farmers are mostly based on experience rather than training.

There is a number of research and higher education institutions in the country covering significant part of the sector expertise area:

- Agricultural university of Tirana
- Institute of animal husbandry research in Tirana
- Veterinary research institute in Tirana
- Forest and pastures research institute
- Soil Research Institute
- Vegetable and Potato Research Institute
- Zootechnical Research Institute
- Plant Protection Institute
- Agriculture Research Institute
- Maize and Rice Institute
- Forage Research Institute
- Tobacco Institute

Research experience is significant from the communist years. However, one significant problem is that previous research activity was focused on very big state owned farms and it has now to reorient to small and medium size farms.

International initiatives and support programs from the World Bank, USAID, EU, UN are working towards strengthening the research capacity in order to provide real services to the sector especially concerning quality control, food safety and veterinary services. Vocational training centers and courses are also organized focusing on very practical issues. In addition, with international support a number of producers and farmers associations were created, providing a first formal base for cooperation.

Another problem is related with the unavailability/high cost of credit for new investments as well as the very high costs for purchase of quality raw materials/inputs.

**Firm strategy** – At this point, the sector is in the beginning of a market-oriented approach. A number of enterprises are looking into creating new production facilities. However, a very large share is still directed towards self-consumption with no market oriented approach and no interest in product and process changes.

**Related industries** - At this point there is also lack of a significant supporting structure for the import of new technologies, pesticides and machinery that together with the unavailability of funding schemes hinder technology transfer. There is also lack of information concerning product and input prices. The almost non-existent distribution network is another problem that limits access to markets. It is very important to create a

wholesale market since it is a required infrastructure to move farmers from subsistence production to a market-oriented approach.

**Demand** – The low purchasing power of the population and the own-consumption tradition, limits demand for added-value products and agriculture development. In addition, an undeveloped agro-processing/food sector does not create the opportunity for improved production. Expected future growth can create the necessary incentives for change.

**Government support** – Government support is focusing on reducing rural poverty and improving infrastructure through the Albanian Development Fund (sponsored from the World Bank and other donors) providing credit support. In addition, the government has organized the extension system network where agricultural experts provide support to small and middle size land-owners.

#### **4. What is the legal framework?**

The ministry of Agriculture and Food is the responsible authority. The Albanian government has fully liberated the agriculture sector allowing for free imports and exports of agricultural commodities and inputs like fertilizers and machinery. In addition, a strategy for improving land use through creating a legal framework for an agriculture land market, is intending to help consolidation and application of mechanical means in larger plots.

#### **5. What are the needs for innovation related training**

Training needs concern both new production methodologies and new technologies in all sub sectors focusing on productivity levels as well for training concerning production management skills.

#### **6. Next steps for ITCB**

Summarizing, the general picture of the Albanian agriculture sector in term of innovative capacity is very limited. It is evident that at least at this point the development will mostly be based on external help and support factors that will create the necessary conditions-prerequisites for the later internal-endogenous development. In that sense, and given the role of agriculture in the economy at this point, there is high need/priority/opportunity for actions in almost all directions.

The following sets of proposed actions are directed toward addressing some of the issues-needs revealed in the study.

- Organize-promote agriculture training in new technologies and production methodologies both for scientists in Albania as well as for farmers. Support/find financial support schemes for the training of Albanian agriculture scientists in Greek institutions
- Assess opportunities for cooperation of relevant Greek research centers with Albania counterparts in specific projects under EU and other international projects. Create linkages with the Albanian institutions. Focus on the areas of quality control and assurance, land management techniques, food safety and veterinary sciences that are critical for exports.
- Examine specific opportunities – support funds available under international initiatives for the agricultural sector in Albania.
- Help-support the organization of an agro-technology fair in Albania to provide information on new production techniques and new improved input material.

## D. ROMANIA

The sector participates 14% of GDP (2000) and occupies 30% of the total labor force, although in rural areas this number goes up to 70%. Agriculture land covers 62% of total Romanian land of which 60% is arable, 34% is pastures and hayfields and 2% vineyards. Of the total product of the sector 61% is plant production, 37% comes from livestock breeding and 2% from agriculture related services.

The study considers Romania agriculture sector as a country of **high technology transfer opportunity and development prospects** given the important role in the economy, the low starting point and the big range of needed services that allows for the full range of cooperation and transfer activities.

### **1. What is the technology status of the sector**

**Plant growing – Grain cereals cultivation dominates production (60% of market) and the productivity of the 3-4 times lower than in EU countries. Major products are cereals (Wheat, barley, maize), vegetables, potatoes and grapes for the wine industry. One of the main obstacles to development is the very small average size of plots (72% smaller than 3ha and only 0.3% bigger than 10has) that decreases efficiency of agriculture machinery.**

- **Machinery:** Farming machinery is in general old (most over 8 years) and in many cases it does not fit with the small size of the private plots. Almost all conventional types of machinery equipment is in use from the industry, either domestically produced or imported. Compared to EU where the ratio is of 12.7 ha/tractor, in Romania it is 60ha/tr.
- **Fertilizers/pesticides:** Nitrogenous, phosphate and potassium fertilizers are used but demand decreased three folds from 1990 to 2000. In addition there is no organized use of organic fertilizers. At this time the use is 4 times lower than EU standards.
- **Irrigation:** The irrigation network covers only 31% of the total arable land and actually only 8-25 % is actually in operational state.
- **Seeds**-There is very low utilization of higher quality seeds from farmers.

**Livestock growing – This sub sector has experienced significant reduction during the last period. Privatization has led to a big number of very small enterprises with very small herds and the lack of the resources for modern breeding methods. The main products are poultry and eggs, cattle and dairy products and pigs.**

- **Fodder** – The quality of fodder used is low and as a result the input to output ratio is very high. Feedstuff is characterized with small quantities of proteins and additives.
- **Stockbreeding facilities:** In general, facilities are old and no modern breeding technologies are used.
- Insufficient dairy products storage equipment that limits marketability of products.

**Forestry** – Romanian forests provide sufficient raw material resources for the domestic industry and also for exports. While over half of the sawn softwood production is exported, the hardwoods are further processed into more value-added products such as

parquet, solid wood panels and furniture. There have been substantial investments in new mills as well as in modernisation of older mills which will lead to significant increase in production in the near future. The paper production is not sufficient to supply the domestic demand for graphic papers. Non-wood forest products have relatively high value in Romania. It is one of the biggest producers of walnuts and medicinal plants in Europe. Fruits and berries, mushrooms and honey are also commercially harvested. Hunting, fishing and ecotourism in Romanian forests are growing.

**Fisheries – Total fish production is 17.000 tonnes of which aquaculture production amounts for 9700 tonnes, 4900 tonnes is inland fisheries and 2500 marine fisheries. The main cultured species are silver carp 33%, common carp 23%, bighead carp 21%. Most fish farming in Romania is either semi intensive or extensive, with limited inputs of feed and fertiliser. There are currently 300 units in aquaculture. The average size of each carp unit is 452 ha the range of farm size is from 2 to 6,400 ha. Some farms produce their own fingerling stocks and may have a surplus to supply other farms either within their own society, or outside. Inland waters (Danube river) fishery is the main activity in the sector.**

**The general technology level is low. Productivity is mainly based on natural factor conditions and there is low technology intensity. Few commercial producers have integrated more sophisticated processing facilities into their operations, which combine filleting, smoking and salting. Icing practices tend to be poor with little use of finely crushed ice or good packaging.**

## **2. What are the technology needs- Opportunities of the sector**

The greater needs in the sector are connected with modernization of equipment and technologies used in the various stages of the production, the application of new production methodologies, improvements in production management and significant measures in the areas of quality and hygiene standards control.

Major needs in technology identified by sub sector are:

### **Plant growing**

- Upgrading of existing technology (machinery and equipment) and better fit to the new land structure (small plots) to increase productivity.
- Extension of the irrigation network and use of new modern irrigation and water management methods in plant production.
- Quality and plant health control systems are necessary to increase marketability of Romanian products.
- New high quality seeds
- The limited use of fertilizers at this point offers the opportunity to develop organic production that have increased added value.

### **Livestock**

- Improvement of fodder quality to increase output/input ratios in livestock production (meat and dairy products)
- New modern breeding facilities.
- Introduction of hygiene and animal welfare standards

- Advance of veterinary control structure and new control technologies

### **Fisheries**

- Improvements of fish farming facilities (deeper ponds)
- Improved quality fingerlings (gene bank, genome manipulation)
- Mechanization of feeding and maintenance and improve feeding process and quality.

### **Forestry**

- modernization of harvesting and processing equipment

## **3. What is the innovative capacity of the sector**

**Firm strategy** - Of the total 11000 existing agri-enterprises 95% are of very small size (1-9 employees.) that limit their investment capacity. A very large share of production is for own consumption with limited interests for higher productivity yields and ability to invest significantly in new technologies.

Existing agriculture companies (agro-processing) follow a technology adoption strategy and their products are mostly conventional mature products. In addition companies stress their internal field – technical experience but consider their relations and cooperation with the external environment and their innovative capacity weak.

**Support structure** - One of the main obstacles to development is the high average age of the rural population and the low education level. Literacy rates are low in rural areas and concerning higher education there is only 1 higher institute graduate out of 100 inhabitants in the rural areas. Agriculture studies graduated are only 1% of the total graduate population and only 10% of them leaves in the rural areas.

Another basic impediment to innovative action is the structure of the rural population in terms of age (more than 50% is older than 50% and 20% over 65) and education (60% is limited to primary education) having a less receptive attitude towards innovation and entrepreneurship and ability to change.

Concerning research and development infrastructure, there are 25 institutes and research centers as well as 91 stations of research all over the country. The number of agriculture related scientists in the country was 1200 -5% of the total research population- (2001 data) and not in proportion to the share of the sector in the national product. The Academy of Agriculture and Forestry Sciences has created a structure comprised of research centers and development agencies that covers most of the relevant areas and cooperate with the technical expertise and consulting services provided to the farmers by the National Agency of Agriculture Consulting local centers. However, their weakness is that they have limited and very specialized capacity and in many cases not able to cooperate in subjects of broad range. The intentions are to decrease the numbers of research centers and increase their capacities.

Financing and credit for agriculture is still hard to obtain and most of it is channeled through Banca Agricola. Significant support to Banca Agricola lending and technical capacity is provided from international organizations (World Bank, EBRD, EU Phare program and SAPARD) is an attempt to increase credit availability to viable investment proposals in all sub sectors.

**Related industries** - An agriculture input producing (machinery, fertilizers, pesticides, seeds, feed) industry is present in the country but it is experiencing significant downtrend

during the last years. Production technology used is old and financing for investments and improvements is hard to obtain. Machinery production covers only a small share of demand and is limited to the more conventional products (tractors, harvesters) and it is directed towards bigger equipment not proper for the small private parcels. Imports of equipment and other inputs were done through big public agromecs that are privatized or under privatization. In addition a small private services market is developing gradually that offers competitive services. Basic agriculture processing industry exists but – following the same pattern with other industrial sectors – it is characterized of old technologies, underutilization of capacity and higher production costs to importers. A very significant problem is the weak structure of the wholesale and distribution network that limits exporting opportunities. The veterinary sector is quite well established. A significant state veterinary control network exists in the country that offers satisfactory services at this point.

**Demand** – At present Romanian domestic market cannot be the driving force for innovation and development of the sector as purchasing power is low. Access to EU and exports can play such a role especially since competition is intensified. The major support factor, however, is the development of the food-processing factor that is in need of high quality raw material, not provided from the agriculture sector at this point.

**Government role** – There is no clear-cut government policy concerning infrastructure investment as well as agriculture human resources upgrade measures. Government policies are expressed in the National Plan paper focus on the creation of optimal sized farms, improving the operation of the agrarian markets to improve efficiency of the whole agriculture activity chain. A significant support measures is the provision of vouchers to farmers for the purchase of seeds, fertilizers and equipment. On the other side, government budget allocation in Agriculture is decreasing during the last years.

#### **4. What is the legal framework for innovation**

The major issue for Romania is the completion of the land restitution process. Although privatization has progressed a big share of agriculture and agribusiness enterprises are still under state control or unclear regimes that inhibit investments and modernization. The government has issued vouchers for input purchases to support small private landowners and, for specific products; it follows a high import tariffs policy to protect domestic producers. EU legislation harmonization is in progress but there are still a number of areas where the legal framework is not clear.

Concerning GMOs, the present status allows for the release to the environment, trade and utilization of GMOs based on approval of the National Committee for Biosecurity that is responsible to authorize introduction in the market. Still there is no requirement for labeling of food containing GMOs. Research for GMOs is allowed and at this point there are more than 100,000 hectares cultivated with modified soybeans.

#### **5. What are the needs for innovation related training**

Very crucial is the support of vocational training schemes to improve the farming and breeding methods. Agriculture companies also expressed training needs in marketing of agricultural products as well as in technology management. In addition, training is also needed for land and production management.

#### **6. Next steps for ITCB**

Following the previous analysis ITCB priority actions should be:

- Identify, communicate and evaluate the existing research and development services and organizations.
- Support research cooperation projects with Romanian private and public organizations with priority areas fodder (for livestock) and seed quality assurance and improvement and plant management methods. (use of IT in land management and production activities)
- Support-organize training courses and workshops in the areas of advanced production methodologies, aquaculture and in organic cultivation.



## E. References

In addition to the studies and data provided from the companies we also used the following supporting documents for each country:

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### **ROMANIA**

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## **APPENDIX D: Studies on Environment**

## **ENVIRONMENT**

The present analysis for the four Balkan countries (Albania, Bulgaria, FYROM, Romania) was carried out with the support of the General Secretariat for Economic Development of the Ministry of Economy in the framework of the Greek-American Initiative for technological cooperation with the Balkans.

The analysis is almost exclusively based on the studies prepared from Euroconsultants and TREK Consulting Ltd. The purpose is to analyze and evaluate the findings, highlight the most important of those and, based on the proposals of the studies, present the most important areas for future action for ITCB.

### **1. Expected results of the studies**

According to the call for tender the studies should provide answers to the following issues- topics that would give a clear picture on the potential for innovation in the ITCB countries

- ☐ assess the technology status of each country and sector
- ☐ assess the technology needs of each country and identify strengths and weaknesses of each sector in terms of the ability to satisfy the needs
- ☐ assess both the current and future legal environment
- ☐ assess the potential of firms towards innovation, the innovation management capacity and the potential for technological cooperation
- ☐ assess the needs for innovation related training in the areas of management, evaluation of technology and marketing of innovation
- ☐ Propose a mechanism for technology transfer

### **2. Analysis of the Environmental sector**

The specific report addresses the Environmental sector of each of the Balkan countries and the related technology fields. The previous questions can be transformed- specified to the following question set

1. what is the technology status of the environmental sector?
2. what are the environmental technology needs of the country
3. what is the existing capacity to fulfill this needs
4. what is the legal framework and the expected developments
5. what are the innovation related training needs of the environmental sector

## B. BULGARIA

The study on Bulgaria was prepared from Euroconsultants based on a technology audit of 8 environmental companies. The findings of the study were based on a number of papers available on the web and a survey of the 8 companies. It should be noted that all studies were conducted before 1998. The speed of changes in the country may make some of the presented results outdated. However, this can be outweighed from the low priority given in the environmental sector and the limited fund availability. Additional information on the state of the environment is provided from the Environmental Action plan for 2002-2006.

The country is considered as **high priority** for technology cooperation, since there are high needs for environmental protection and EU accession is expecting to create an additional pressure parameter, plus the fact that there is general good attitude towards US technology.

### **1. What is the technology status of the environmental sector**

The sector is relatively new. It comprises of around 100 enterprises of which more than 50% were established after 1990. They are mostly SMEs. The size of the market in 2001 was around 170 million USD. The principle area of focus is the water and wastewater treatment area and in a second level air pollution. The main technologies used are imported although it is stated that local technologies are also used indicating prospects for growth although at this point they are only in the low quality segment with limited sophistication.

In terms of technology use in the environmental sector, based on the interviews of the study the current technology used for each main body is:

- **Air** – Air pollution control and prevention is in significant use from industry.
- **Water** – The main focus is in sampling-lab analysis and pollution prevention/waste minimization technologies.
- **Waste** – There are only some common processes for industrial waste treatment in use.
- **Noise** – Protection equipment as well as measuring and control devices are in use.

### **2. What are the environmental technology issues and needs**

The study the environmental needs of the country, the national environmental action plans and other sources of information point to a number of important issues:

- **Air** - The decline of the economic and industrial activity during the last years led to a decrease of emissions of a number of pollutants especially concerning point sources. However, the expectations for future economic growth will change this picture if adequate measures are not taken. The most significant problems are connected with:
  - the use of high sulphur content coal in the energy producing industry (power plants).
  - the use of high content leaded gasoline in transportation and combustion in all industrial processes

- the increase of traffic in the main urban areas and the resulting emissions of NOx and VOCs
- burning of solid fuels from energy producing industry and production of particulates
- the metal extraction industry uses heavy metals (mercury) with significant levels of emissions
- agricultural activities create significant amount of methane and ammonia emissions
- methane emitted from the extraction and processing of fossil fuels

**Opportunities** - The basic needs – opportunities for technology transfer that arise are for pollution control and pollution prevention technologies for

- minimizing emissions from point and mobile sources, especially in relation to the use of sulphur and heavy metals. (DESOx, DENOx, filtering, etc)
- the use of cleaner technologies in the areas of energy production and the use of alternative fuels to decrease the use of heavy polluting high sulphur coal.
- there are significant needs in upgrading the monitoring system. The current system provides a good picture but it does not measure all pollutants (e.g. ozone.) and it is not fully automated.

□ **Water** – The main problems concerning water are

- the poor status of the drinking water system that leads to significant losses (up to 70%). The water supply system is old and the drinking water quality monitoring system is poorly equipped
- the sewerage system is limited to the main cities and quite old and due to frequent overload there are discharges in the rivers basins
- Wastewater production is mainly (70%) from the industrial sector. Industrial facilities waste water treatment covers only 65% of the total wastewater – the remaining is discharged in rivers and the sea.
- Municipal wastewater treatment covers only 36% of the population and in not all big settlements. There is no third degree treatment facility and 25% of the existing sites provide only 1<sup>st</sup> degree treatment.
- Lakes and rivers face significant threats of eutrophication due to the use of fertilizers in agriculture. Only 64% of coastal marine waters comply with EU directive water quality requirements.

**Opportunities** - The main opportunities for technology transfer are in the following areas

- industrial and urban waste water handling and treatment
- waste water minimization technologies.
- Water management systems
- Quality control and monitoring system for drinking water and water basins

**Waste - In the areas of solid waste handling and treatment there are significant problems and threats to the environment.**

- Industrial waste comprises more than 70% of total waste and in many cases industrial landfills – most of the times not properly constructed and over used- contaminate soil and neighbor water basins. In many other cases industrial waste is treated in landfills together with municipal waste.
- Municipal landfills do not fulfill EU directives' requirements and in many cases they lead to underground soil and water contamination.
- The only waste treatment method used is land filling. Incineration, composting or other advanced waste treatment methods are not used but a hospital waste incineration that is not following set standards
- Industrial waste recycling and reuse is used for glass, paper, plastic and scrap up to 50% of industrial waste. However there are no general recycling schemes for recovery, recycling and reuse.
- Uranium mining, wastewater treatment and petroleum refining activities create significant amounts of hazardous substances. Neither measurement and monitoring facilities, nor the appropriate treatment facilities are available, thus leading to the discharges of hazardous waste in common landfills and posing significant threats to the environment and public health.

**Opportunities** – The national environmental plan gives high priority to solid waste treatment, especially in the areas of urban waste. The main opportunities for technology transfer are in the areas of

- Solid waste monitoring, handling and treatment especially alternatives to landfilling like incineration and composting
- Energy production from waste
- Solid waste recycling and reuse
- Medium and high hazardous waste treatment technologies

**Soil – The major uses related to soil pollution are**

- Contamination resulting from waste discharges and industrial activity, especially connected to the past industrial activities, covers 0.7% of the arable land and poses threat to the water basins and the quality of agriculture production.
- Uranium mining and the processes involved are posing significant contamination of the soil.
- Soil erosion from irrigation, water and wind is a problem for 70% of arable land.

**Opportunities** – The most important opportunities refer to:

- Soil remediation projects in a number of hot spots in Bulgaria.
- Sanitation of mining and other production sites.
- agriculture production modernization and modern stock breeding methods can improve the use of land and decrease side- effects.

- **Biodiversity** – The main threats for biodiversity are posed from the open-pit coal mining activities and the destruction of extensive areas of land, natural habitat of

many species. In addition extensive forestry and fires are also threatening biodiversity.

- **Noise** – Noise is a problem for urban areas in Bulgaria and it is associated with transport and traffic as well as other industrial activities.

**Opportunity** - The main issue and area of interest is the creation for system of noise emissions monitoring and control to supervise noise levels. The existing level of monitoring system technical equipment is low.

**Horizontal needs – in terms of business needs we can highlight the fact that companies give prior importance to:**

- PC supply, networking and internet connection
- demand for quality control systems and lesser degree control quality assurance and management systems

**3. What is the capacity of the sector for innovation and technology transfer**

**Support structure** - In terms of knowledge capacity and research potential of the sector some important points must be stressed:

- there is significant technological infrastructure that covers almost all relevant areas. The major pressing factor is the lack of funding. The educational system is recognized as good in general.
- universities are more inclined towards education rather than research, since there is only limited funding to support research. the links between research centers and enterprises is very weak and companies do not consider universities are strong innovation factors
- the share of total research to GDP is around 0.2% and the environmental sector is not a priority sector
- there are additional sources of funding come from participation in EU 5<sup>th</sup> and 6<sup>th</sup> framework programs

In terms of technology information used by companies, the main sources are personal contacts, conferences and journals.

**Firm strategy** - In terms of internal innovation capacity of the firms assessed the potential is in general low, since only 15% of the companies' workforce holds any type of technical degree and training qualification. Local firms can supply only low-tech equipment and they do not have the capacity to compete with foreign firms in high tech areas. The size of the firms is relatively small leading to financing problems and inability to undertake big risk-posing projects and invest in R&D. The general attitude is negative towards cooperation and there are few technology cooperation projects and joint ventures with other organizations and foreign companies and are very few.

**Demand** – At this point demand is driven from municipalities concentrating mainly in solid waste management, recycling and industrial waste handling. The integration of pollution prevention considerations in industrial processes in the private is expected to increase demand for the whole range of services and products. It is expected that future needs will move from basic low-tech pollution control equipment to more advanced and sophisticated technologies that will provide cost reduction benefits.



**Government role** - The prospect of accession into the European union for Bulgaria creates pressure for improvement in all areas of environmental activities. The introduction of polluter pays principles affecting the costs of industrial activities, the obligation for air, water and soil protection based on the EU directives is a significant driver and opportunity for the Bulgarian environmental industry. An additional measure taken was that environmental audits were required during every privatization process.

#### **4. What is the legal framework**

**Responsible authorities** – The Ministry of Environment and Waters responsible for environmental protection policy and legislation. There are 15 regional inspectorates and municipalities are also responsible for implementation of policies, construction of environmental projects, and control of the implementation of legislation. Regional Sustainable development councils are responsible for issues concerning regional sustainable development.

#### **5. What are the needs for innovation training of the environmental sector**

Companies express interest mostly in management and technology transfer areas rather than pure technical skills. The companies show interest in technology transfer skills and procedures and propose the following areas as the most important needs for training

- a. Environmental management
- b. Financing environmental investments
- c. Project management

In addition, In terms of new technology information, Internet and conferences are pointed out as the two most significant methods for information around the environmental business sector. Conference attendance is considered a meeting-networking opportunity rather than a training event.

#### **6. Next Steps for ITCB**

Based on the previous analysis and the recommendations of the study we can say that the environmental sector is one of high priority for technology cooperation. The expected amount of investment in the area is very big, as well as the needs of the country. The innovation potential is weak but more work should be done to assess its actual dimensions. Future steps shall include

- Identifying the stronger research centers and technology players in Bulgaria in the areas of environmental studies and engineering
- Prioritizing in the areas of
  - Waste/wastewater handling methodologies, recycling and reuse technologies
  - Monitoring and control systems that can be combined with the IT sector
- Given the general positive attitude towards conferences and similar events, organize events that will bring together companies and research institutes
- Follow up with the existing development initiatives that bring significant funds in the country and try to support supplementary and synergistic plans.

## B. FYROM

The study in FYROM was prepared from Euroconsultants based on a technology audit of 15 companies and the review of the reports concerning the general status of the environment and environmental sector. The study proposes that the country should be considered of **high priority** since there are great needs for all types of technologies and investments and a positive attitude towards US technology.

### **1. What is the status of the environmental sector**

The technology level is in a very infantile stage. Only few pollution prevention technologies are in use. In general, equipment is outdated.

In terms of technology used in the environmental sector of FYROM the studies provide the following information:

- ❑ **Air** – Air control and gas purification systems are used in the energy producing sector, metallurgy and chemical industry. In most cases technologies are over 10 years old.
- ❑ **Water** – The standard treatment technologies are used and in some cases recycling and reuse, waste minimization and pollution prevention. More advanced technologies are not used from the existing environmental companies.
- ❑ **Waste** – The common treatment processes (collection, landfills) are used from all industrial waste producers.
- ❑ **Noise and vibration** – Moderate use of protective equipment and control systems from almost all industrial companies.
- ❑ **Energy** – There is a general minimum use of energy saving technologies in the thermal power plants.

### **2. What are the environmental technology issues and needs**

The study, as well as additional sources of information, point to the following areas of technology needs:

- ❑ **Air** – Air pollution is considered the most important environmental problem in FYROM, especially affecting urban population.

The major problems of air pollution are connected with

- the use of high sulphur-content (6%) gas and lignite burning from thermal power plants and other industrial processes
- the production of NO<sub>x</sub> from mobile sources and thermal power plants – high concentrations are measured in specific urban areas
- emission of particulates from various industrial processes – connected with the low quality of the solid fuels – is connected with occurrence of respiratory diseases in specific areas of FYROM
- heavy metals are emitted from the cement industry
- an adequate measuring-control system is not available

**Opportunities** – The greater opportunities-needs that arise are in the following areas

- air pollution control and pollution prevention technologies (DESO<sub>x</sub>, DENO<sub>x</sub>)
- use of energy efficient technologies and exploitation of geothermal energy and renewables

- upgrade of the monitoring network in order to cover all types of pollutants and get more reliable information

- ❑ **Water** - The most important issues connected with water bodies are:
  - Water resources are not properly managed
  - Only 6% of wastewater is treated before discharge in the rivers and only 3 cities have municipal wastewater treatment facilities.
  - There are specific water basins (Lake Ohrid and Lake Prespa) where untreated industrial and urban wastewater and high nutrient- content water from agriculture use are discharged creating eutrophication
  - The monitoring system of surface water is updated, however, there is no functioning groundwater monitoring system and water use management system.

**Opportunities** - The most obvious technological opportunities for FYROM companies and outside investors are:

- renewal and update of the monitoring- control systems of water and wastewater
- water use management system
- sewerage system upgrade
- waste water treatment facilities in urban areas

- ❑ **Waste** - The most important problems concerning waste are connected with:
  - use of inappropriate-illegal disposal sites (dumps) to discharge industrial and municipal waste
  - industrial and hazardous waste are discharged together with municipal waste and there are no treatment ( landfills) facilities
  - existing landfills do not have the proper technical characteristics, causing significant pollution of air, water and soil

**Opportunities** – Based on the previous description we can foresee a number of technology transfer opportunities:

- waste handling technologies
- industrial-hazardous waste treatment
- waste minimization technologies
- recycling-recovery-reuse techniques

- ❑ **Soil** – The main soil/land problems are:
  - erosion (38% of the land) due to extensive forestry and poor farming practices, especially in connection with irrigation
  - significant contamination associated with disposal of hazardous-industrial and municipal waste in uncontrolled dumps and landfills
  - specific hot spots with extensive pollution from hazardous-toxic substances originating from specific industrial sites
  - lack of a monitoring-control system to check the status of soil quality

**Opportunities** - The greatest opportunities for technology transfer that arise are:

- site remediation technologies and techniques
- soil control monitoring system

- irrigation techniques that will minimize erosion

□ **Business needs** – In many companies it is indicated that the most important parameter is the reorganization of production following environmental management practices. There is also demand for: -

- the introduction of environmental management systems (EMS)
- automatic controls of production
- energy efficient- saving technologies PC systems
- networking and internet access
- Quality control and assurance systems

### **3. What is the capacity for innovation of the environmental sector**

**Support structure** - In terms of support structure, the country is weak. Despite the good general literacy rate in the environmental sciences area there are significant deficiencies. No environmental science or environmental engineering department exists in the universities of FYROM. As such there is limited availability of technical knowledge creation in the country and skilled personnel provision in the specific sector.

The Regional Environment Center in FYROM and the National Center for Pollution prevention are organizations with significant activity and potential for participation in technology transfer cooperation.

In terms of the main barriers to technology transfer, the most important point mentioned is the cost of acquiring new technology, financing and the problems of technical service and maintenance, due to the lack of technical expertise in the country. At the same time, foreign technologies are generally preferred for their reliability and better quality.

**Firm strategy** - The majority of the environmental companies audited had a significant size (number of employees more than 100) but most of their employees had a very low educational level (non-university training). Investment in R&D this is limited but companies show significant appreciation to technology improvements and consider financing the most significant obstacle.

In general, companies are dynamic towards introducing new technologies and expressed demand for using IT both in production and administration, automation systems and quality control systems. New technology information is acquired mainly through internet, conferences and seminars that serve as meeting points for cooperation and information exchange.

**Government role** – The government has set the National Environmental Action Plan with a comprehensive policy framework in almost all areas. However, at this point there is absence of substantial financial support to transform policy intentions to real actions.

One positive measure concerning investment in environmental technology is that companies are taxed-exempt for profits reinvested in environmental projects.

**Demand** – In terms of need for environmentally friendly it is evident that there are great prospects in almost all relevant areas. From the industry side, there is limited request for environmentally friendly technologies because of the short-term view and the lax environmental law enforcement.

### **4. What is the legal framework**

**Responsible authorities** – The ministry of Environment is responsible for environmental protection and municipalities are responsible for implementation of state policies in local

level. The ministry of agriculture, forestry and water management plays also a significant role.

A basic environmental protection framework exists upon which a number of legislation acts have passed during the previous years. The general trend is towards adopting EU standards in some areas, although there is significant consideration about the needs of the country in connection to the development efforts. The polluter pays principle is established and the money collected are used from the Environmental Fund for environmental projects. The main problem is the very lax enforcement of environmental standards and the low level of fines creating a disincentive for pollution prevention measures.

### **5. What are the needs for innovation training of the environmental sector**

Given the absence of any type of university-technical university providing training in the environmental sector and the high degree of non-university trained personnel in the sector we can say that there is a significant gap that needs to be filled. It concerns:

- Technology-technical skills
- management and marketing skills

### **6. Next steps for ITCB**

The study reveals some important next steps.

- Wastewater treatment, air pollution control and solid waste handling and treatment should be the priority areas for action.
- Identify contact points, possible partners in technology transfer. Given the lack of research infrastructure such an attempt should include all possible types of players (enterprises, government, local authorities).
- Identify those sources of funding that support environmental projects and the opportunities in the areas of research cooperation provided in the country since funding is considered as the most important barrier to new technologies.
- Technical seminars and conferences focusing on bringing together all experts from FYROM with the purpose to create a critical mass of technical expertise.

## C. ALBANIA

In the environmental sector, the study proposes that there are **low prospects** for technology transfer and cooperation. This is based on the low priority given to the environment from the Albanian government, the fragile political conditions and the absence of a minimum critical technology base.

### **What is the environmental technology status**

Environmental protection in the country is essentially non-existent. More specifically

**Air** - There is complete lack of technologies concerning air pollution monitoring and control.

**Water** - Water quality measurement sampling equipment is used but no water and wastewater treatment technologies.

**Waste** – Some type of pollution control equipment and decontamination is used by the National Environmental Agency. No waste management and waste treatment facilities.

**Noise** – Monitoring and control devices are used.

### **What are the technology needs of Albania in the environmental sector?**

Based on the results of the study and additional updated sources of information the most important environmental issues and needs of the country by environmental body are:

□ **Air** – The decline of economic activity has decreased the severity of air pollution coming from industry. The main pressure factors of air quality are the following

- transportation, due to the use of old cars and burning of high sulfur content leaded gas
- particulate matter and toxic emissions created from municipal waste burning in open areas
- the complete absence of cleaning technologies (end of pipe, pp) from all industries that emit all types of toxic gases. Especially the chromium ore smelting industry – the major industrial activity in the country- has the greater portion of emissions.
- A particular problem is the use of ozone depleting substances (freon) from cooling systems.
- The most important problem, however, at this point is the lack of an organized monitoring system. The only pollutants monitored are SO<sub>x</sub> and NO<sub>x</sub>, and still they are only partially analyzed.

**Opportunities** - The opportunities that arise from the current situation are connected to:

- the creation of a monitoring control system that would provide up-to-date information of ambient air quality and air emissions.
- technologies for substitution of ozone-depleting substances for cooling systems
- pollution prevention/control technologies for all types of air emissions
- Introduction of cleaner technologies especially in the refining and copper smelting industries

□ **Water** – While water resources in Albania are abundant there is complete lack of any protection measures for the quality of water.

- Water basins are polluted from all types of discharges from industrial and municipal activities that flow free to water bodies without any type of treatment
- There are no waste water treatment plants in Albania
- Industrial plants discharge all types of toxic chemicals in the river basins and water bodies without using any pollution control equipment
- The oil industry is the greater source of pollution. All types of activities are connected with discharge of high BOD, COD (phenols) substances in large quantities in river basins and coastal waters.
- There is only one operating drinking water plant in the country that can not covers the needs of the population
- 50% of city water is lost due to leakages of the water supply network, that is poorly maintained and allows for infiltration and contamination from sewer lines
- coastal marine waters of Adriatic have high concentrations of POP

**Opportunities** – The main needs/opportunities for technology transfer include:

- monitoring and control equipment and water management system
- municipal wastewater treatment facilities
- pollution control- cleaner technologies for all types of industrial activities in Albania

□ **Waste** – The main issues connected to solid waste are:

- the increase of urban waste, especially in the cities with any infrastructure for handling and treatment. All urban waste is discharged in uncontrolled landfills that pollute soil and watercourses
- Inability to handle the amount of urban waste especially in urban areas and lack of appropriate collection equipment
- Industrial waste from copper-chromium extraction and processing, oil refining and thermal power plants is disposed together with municipal waste without previous treatment
- Various types of toxic chemical substances (cyanide, mercury salts, expired pesticides etc.) are stored under improper conditions (no ventilation, torn bags, broken barrels)
- There is no inventory of the hazardous substances that enter the country

**Opportunities** – The opportunities-needs for technology transfer that arise from the previous description are:

- the creation of landfills for municipal waste treatment
- industrial- hazardous waste treatment facilities
- waste management system
- recycling and reuse systems and technologies

□ **Soil** – The main problems identified are:

- physical erosion due to the mountainous landscape is accelerated from soil erosion from agriculture, free flow irrigation, extensive woodcutting and dodging of rivers for construction materials

- Severe contamination of soil due to inappropriate storage of toxic chemicals and hazardous substances in wells and dumps.

**Opportunities** – There is great need and opportunity of technology and knowledge transfer

- for remediation projects, especially for the “hot spot” areas contaminated with various toxic and hazardous substances.
- For irrigation management

There are basic/fundamental needs for the environmental sector, concerning equipment and technical expertise in the areas of air, water, solid, waste.

□ **Biodiversity** – Albania is considered having among the greatest biodiversity loss in Europe. Especially endangered are the marine and coastal ecosystems, affected from the extensive pollution from all type of discharges.

**Business needs** – Companies technology needs expressed from companies are mainly in the following areas:

- Personal computers, networks and internet connection
- Telematics-remote sensing systems
- Energy saving/efficient technologies

**What is the capacity of the environmental sector in Albania to fill these needs?**

**Support structure** - The capacity of the sector to respond to current needs is very low. There is significant lack of infrastructure and technical capacity to adopt and use new technologies. The problem of financing is considered the greatest barrier to the introduction of new technologies as well the problem of technical expertise availability. In addition, local availability is problematic and information on new environmental technologies is limited.

In terms of knowledge infrastructure there are a number of institutions, research centers, and university departments focusing on the area of environment. There is

- Environmental engineering department in the Polytechnic University of Tirana
- Environmental geology department in the Polytechnic University of Tirana
- Departments of geography, biology and chemistry in the University of Tirana, Shkodra, Elbasan and Gjirokastra
- Environmental sector in the Agricultural university
- Research institute of chemical technology
- Institute of hydro-meteorology

However, no information is provided for the research capacity and ability to participate in technology transfer although universities and research centers are considered as substantial source of information.

In terms of finance support, the main sources are from international organizations (USAID, World Bank, EBRD, UNEP) for specific projects addressing the needs of the country. In addition, the Albanian Development Agency is supporting SMEs and providing a range of business development services.



**Demand** – Although the country faces significant acute problems and a big number of hot spots, environmental protection and integration of into the greater industrial development process is still limited in the projects of international organizations. As such demand for environmental technologies is very limited. Even in the public sector, environmental projects are based on provision of financing and are not a part of the national priorities program.

**Government role** – Government role is very limited in the promotion of adopting environmental technologies. The government is financing through the National Environmental Fund research projects in specific environmental areas. However, financial resources are limited (only 0.1% of the budget goes to the environment and an Eco-Fund planned has not been established yet. One positive measure reported, in connection to privatization efforts, is that there is a requirement that an environmental impact assessment must be conducted

#### **What is the legal framework?**

**Responsible authority** - The National Environmental Agency, an entity subordinate to the council of ministers, is responsible for environmental policy. It also has 12 regional environmental agencies responsible for enforcement and monitoring of environment conditions.

There is no clear legal framework concerning the protection of the environment. Lately, Albania has become party to a number of international environmental agreements and has incorporated them into its legal framework. However, enforcement capability is very limited. In addition, there are significant disincentives for introduction of pollution prevention, environmental friendly technologies and measures.

#### **What are the needs for innovation related training of the environmental sector?**

The sectors needs support in the fundamentals of technology transfer and innovation. More specifically there is need for

- Training new personnel in environmental technologies to provide the market with skilled labor
- management of technology
- Enhance the information channels for new technologies, especially through conferences and exhibitions

#### **Next steps for ITCB**

The study points out that there are basic needs in all environmental technology areas. ITCB should

- Contact the existing Albanian research centers and explore their potential for participation in research projects in connection to specific projects taking place in the country. Create the necessary initial linkages.
- Organize environmental technology events that would also serve as brokerage events for companies- enterprises selling environmental equipment.
- Support/organize educational exchange schemes for the improvement of the training capacity of Albanian universities.

## D. Romania

The study in Romania was performed from TREK Consulting SA. The focus of the study was more towards the use of various innovation related tools and the presence of all the essential parameters for an innovation system and not a description of the environmental status of the country and the technologies used protecting the environment. The difference could be described as amore micro versus a more macro-sector approach. According to the study the **prospects in Romania for technology transfer are good** given a medium to low current technology status and decreasing competitiveness due to outdated technologies, a significant knowledge and support framework, the urgent need for intervention and progress in a number of environmental problems in the country, and a relatively positive attitude towards technology transfer.

The study also proposes that the most interesting areas for cooperation, as stated from the interviewed companies, are to transfer expertise in market access and in research and development. Subcontracting and turnkey equipment purchase is also desired from Romanian companies.

### **What is the technology status**

The study did not provide with a detailed review of the existing technology level.

Concerning the general infrastructure:

- The water supply network is limited and covers only 75% of the streets lengths. In rural areas network coverage is much smaller. In addition, the equipment is overused and inefficient.
- The sewage network is much more limited covering only 20% of the total number of localities.
- Gas supply network covers 70% of the urban and 31% of the rural population.

There is some environmental equipment manufacturing activity in Romania, but it is in the low-end segment and it is basically producing components for protection equipment in joint ventures with foreign partners.

## **2. What are the technology needs of Romania in the environmental sector?**

The study itself provided only minimum information on the state of the environment and the most crucial-important priorities for Romanian environment. Based on additional reports from UNEP we can summarize the most important issues and opportunities/needs for technology transfer by environmental body.

- **Air** - The greater problems of air pollution are connected with the use of old high polluting technologies. Economic activity decline during the last decade downgraded the intensity of these problems. However, future growth may bring them back. The main problems come from:
  - High sulfur content fuel burning for transportation and in industrial activities (thermal power plants, oil refining) with absence of sufficient control technologies connected with acid rain incidents
  - High NOx emissions from old cars and thermal plants creating specific hot spots with high concentrations

- Inefficient energy producing technologies with high greenhouse gases emissions
- Significant heavy metals emissions from metallurgy and cement industry
- High emissions levels of particulate matter from cement and metallurgy sector
- Waste burning in open (inappropriate) landfills creates toxic emissions
- Absence of a modern and extended monitoring network that would cover all pollutants and provide up to date information

**Opportunities:** The opportunities for technology transfer can be concentrated in the following areas

- introduction of new energy efficient technologies
- introduction of alternate fuel and renewables to decrease the dependence over poor quality coal
- new pollution prevention and control technologies (e.g. DESOx, DENOx)
- upgrade- modernize monitoring system and measurement equipment

□ **Water** – The main problems concerning waters quality is associated with the discharge of untreated wastewater from urban and industrial (especially chemical industry) activities

- Insufficient treatment of wastewater (18% properly treated)
- Discharges from agricultural activities (farming and stock breeding) are not properly treated
- specific water basins (Danube river and Black sea coast) receive significant amount of untreated wastewater that affects water quality (increasing eutrophication in water basins)
- there is no tertiary treatment facility for industrial wastewater
- only 75% of population is connected to the sewage system that is outdated
- phreatic level groundwater in many areas is significantly polluted from oil industry discharges and agriculture

**Opportunities** – The main opportunities that arise for technology transfer are:

- wastewater treatment facilities and new modern treatment technologies
- pollution control and water use management systems

□ **Soil** – **The main problem areas are:**

- Arable land is decreasing in favor of urban area and the quality of the land is deteriorating.
- Soil erosion associated with natural and anthropogenic activities (primarily agriculture and irrigation)
- Significant soil contamination resulting from mining activities and abandoned mine facilities as well as from inappropriate waste treatment plants and oil extraction facilities.

**Opportunities**

- Introduction of cleaner technologies especially in the mining sector
- Improve monitoring network
- recultivation technologies for decontamination –remediation of specific lands

❑ **Waste** – Waste (industrial and urban) poses significant pressure in the state of the environment

- only 5% of total waste produced is currently recycled and reused
- existing landfills are inappropriate (only 30% cover requirements) and leakages contaminate underground soil and water
- hazardous waste from mining, chemical industry and thermal power plants as well as hospital waste are disposed together with municipal waste

**Opportunities** – The needs for technology are in the following areas

- Modern landfills and alternative treatment techniques for urban and industrial waste
- quality control of the surrounding environment of treatment facilities
- waste reduction technologies
- recycle – reuse- recovery technologies

❑ **Biodiversity** – The main problems that arise for the biodiversity of Romania are

- extensive forestry decreased species habitat areas
- extensive fishing in the coastal areas decreases the fish population
- there is no ecosystem monitoring

### **3. What is the innovation capacity of the sector**

**Firm strategy** – Firms have a positive attitude towards innovation and recognize the need of upgrading in order to follow foreign competition. They use trained personnel and invest in additional training of their workforce and they also use various information sources to keep informed about developments. In addition, they are looking for cooperation schemes and joint ventures for new projects. Their R&D activity is still limited in adoption of technologies.

**Support structure** - In terms of national research, innovation and technology transfer infrastructure we could point out that there is a substantial research base comprised of university laboratories, research institutes including among others:

- a. The institute of environmental research and engineering,
- b. The Danube delta- institute of research and design
- c. The Research institute for waste water treatment and
- d. The National institute for marine ecology and geocology
- e. Research center for quality and environment protection
- f. National institute for research and development for biotechnology
- g. ICPE Electrocond technologies

There is also infrastructure for the cooperation and communication of these research centers. Most of these centers have already participated in the 4<sup>th</sup> and 5<sup>th</sup> framework programs and have acquired additional research capacity and experience. Further analysis on the research projects by center and research capacity is necessary to create a full map of the research capacity of the country. The current trend and focus is towards applied research.

There is also a number of technology transfer, research and innovation diffusion centers active in Romania as well as information sources for new technologies (libraries, journals and databases concerning new technologies and research results). The most significant

financing sources are from international organizations (UNEP, World Bank and EBRD), as well as the EU pre-accession countries ISPA and Phare support tools.

**Government role** - The overall strategy of the government is towards a EU compatible system that will allow for larger participation in the EU research programs. The government intends to address both past and new responsibilities for the environment and the industrial development plan incorporates environmental protection, rehabilitation of existing hot spots and creation of environment management structures. Towards this direction tax and credit incentives have been introduced to support pollution prevention and the polluter pays principle is applied. One important issue though, is the enforcement capacity of the government and the ability to implement its policies.

**Demand** – Demand for environmental technologies and services is expected to grow significantly in the future. Besides the present issues described earlier, more stringent regulation complying with EU standards and integration of environmental assessments in almost all internationally funded projects in the future are expected to create a market for all range of environmental technologies and services. New investments in all sectors are required to use environmentally friendlier technologies.

#### **4. What is the legal framework for innovation**

**Responsible authorities** – The Ministry of Waters, Forestry and Environmental Protection is responsible for environmental protection and legislation and the ministry of Industry and Trade responsible for policies dealing with energy, fuel quality. 42 local environmental agencies are responsible for monitoring and enforcement. The main driving force in the area of environment, is the EU accession and the requirement to harmonize legislation with EU in the near future.

#### **5. What are the needs for innovation related training**

The study does not provide with clear answer as to the needs of the environmental sector for training. We can infer from the various answers the following:

- technical expertise is considered a strength from the companies and as such focus shall be given in training for advanced environmental technology areas and subjects
- marketing of technology is considered a weak point and market access is considered in the study as the most needed area for training
- There is need for innovation transfer management expertise and technology transfer tools that would facilitate effective transfer of technologies in the environmental sector.

#### **6. Next steps for ITCB**

Based on the analysis and the recommendations from the study we can conclude that the next steps for the country of Romania should focus on:

- Identify, contact all innovation related players (research centers, innovation-business centers, technology transfer centers) in the environmental sector and assess the capacity to participate in technology transfer initiatives.
- Identify the financing entities-schemes-opportunities that are connected with environmental projects and technology transfer.
- Prioritize for technology transfer in the areas of:
  - Mining extraction and pollution prevention-minimization from mining activities

- Improved energy efficiency processes in all industrial activities
- Waste and wastewater treatment processes as well as minimization technologies

## References

In addition to the studies and the data provided for the companies from the questionnaire, the following supporting documents for each country were used for this report:

### **Bulgaria**

1. [UNEP National Environmental profiles, Bulgaria Profile](#)
2. [Bulgarian Ministry of Environment and Waters, National Strategy for the environment and action plan 2000-2006](#)
3. [Regional Environmental Center for Central and Eastern Europe, The emerging environmental market](#)

### **Albania**

1. [GRID Arendal, State of the environment report](#)
2. [UNEP, Post conflict environmental assessment, Albania](#)

### **FYROM**

1. [UNEP, Post-Conflict environmental assessment FYROM](#)
2. [FYROM, Ministry of Environment and Physical planning, State of environment report 2000](#)

### **ROMANIA**

1. [GRID Arendal, Environmental Performance reviews](#)
2. [Regional Environmental Center for Central and Eastern Europe, The emerging environmental market](#)

## **APPENDIX E: Studies on Food and Beverages**

# FOOD AND BEVERAGES INDUSTRY

The following analysis is almost exclusively based on the studies prepared from Euroconsultants and TREK. The purpose of this analysis is to analyze and evaluate the findings, highlight the most important of those and, based on the proposals of the studies, present the most important areas for future action for ITCB.

## **1. Analysis of the sector**

The sector includes food processing, beverages and alcoholic drinks producing industries, distributors and traders and food processing equipment producers and traders. It is important to recognize the direct linkages of the food and beverages sector with the agriculture sector and the critical role of the latter for the development of the first, especially for the four countries of ITCB with a large share of agriculture in GDP.

## **C. BULGARIA**

The sector is considered as of **medium to high priority** from the study, given the presence of a significant production capacity that is not utilized at the moment, the importance of the sector to the country economy, the opportunities and needs that arise from EU accession and the significant presence of Greek enterprises in the country. It is also points out that there are some sub sectors such as wine and canning production with additional competitive advantage.

### **1. What is the technology status of the sector**

The food and beverages sector is one of the most dynamic of the Bulgarian industry participating in 4% of the country GDP and 20% of the total industrial output.

The main characteristic that applies to most of the industry sub sectors is that the privatization of the state enterprises of significant capacities and the loss of the Soviet Union markets has led to significant underutilization of the capacity. At the same time the loss of markets and financing has constrained financing of investments. As a result, in most areas existing technology is outdated and underperforming.

Analyzing the industry by sub sector we can say:

- **Wine industry** – It is one of the strongest sub sectors. Bulgarian wines have created a brand name that allow them to penetrate western markets (80% and more of production is exported). However, the technology used in most wineries is old and there is need for upgrading. More crucial is the fact that existing grape production does not cover industry capacity and in many cases it causes underutilization. In addition there is a significant problem of grape quality.
- **Dairy industry** – The dairy industry is also a strong sector, with significant exports. The sector comprises of few big (75-100tons/day) formerly state-owned producers and a big number of small (5tons/day) enterprises. The sector lacks of quality control and assurance systems and small producers provide low quality milk. This has led to a ban of exports from EU and now there are few enterprises that are EU authorized. In addition technologies used are old, hygiene standards in production are not followed in many cases as well as proper storage of products.



- **Canning industry** – The canning industry is one of the strongest sub sectors of food industry. The major products are canned vegetables and fruits as well as jellies and jams. Most of the companies (85%) are private. Technologies used in the industry are old and they have not been upgraded leading to low productivity and efficiency levels. In general at this point the industry is providing low quality products that inhibit strong presence in the EU market.
- **Brewing industry** – The brewing industry is comprised of private small to medium enterprises and provides with medium quality beer. The level of technology is characterized as medium and a major issue is the low quality of barley that does not fit with the technological requirements too.
- **Meat processing industry**- The meat processing industry is comprised of 560 enterprises of which a small number are large integrated units with slaughtering and processing facilities with the biggest share concentrated in meat processing. In general the companies work in half capacity mostly because of the decline of meat output during the last years. Technology used is in general outdated with facilities in poor physical condition and poor veterinary and sanitary control. However, new investments have been made and there are few companies with modern equipment following EU standards. As a result only very few enterprises are authorized to sell in the EU market.
- **Oil crop production and processing** – Focus is on sunflower seeds. Technologies used are in general outdated. There was an increase in total lately but utilization is below 50% and production costs are high.
- **Tobacco** – Tobacco production is carried out by the state-owned Bulgartabak which is among the 6 biggest tobacco companies in the world. Exports account for 3% of total country exports and 30% of agricultural products.
- **Sugar** – The sugar processing industry is comprised basically of 7 companies (4 private). They are outdated in terms of equipment and production methods and in connection with low sugar beet production (95% imported) and high labor costs, they are considered as of very limited potential.

## **2. What are the technology needs**

The previous descriptions reveal the need for upgrading of existing equipment and technology in all sub sectors. Very crucial areas are:

- of quality and hygiene standards (ISO 9000 and HACCP) that are critical for competing in the international markets.
- the introduction of quality control laboratories and quality assurance systems.
- Investments and upgrading in supply chain management, which is necessary to cut costs and improve productivity.
- Packaging and labeling technology to improve marketability of products

In addition, by sub sector more specific needs are expressed.

- **Wine industry** – Significant need is expressed for grape processing equipment and technologies.
- **Canning industry** – Need for new equipment and technologies and for modern automatic controls.
- **Dairy industry** – Demand for cooling and storage facilities

### **3. What is the capacity of the sector for innovation and technology transfer**

**Related industries** – In general, at this point most of the supporting-related industries in Bulgaria are weak, hindering the development of the sector. Agriculture production is not stable in quantity and quality and at the same key linked industries such as packaging and transport are not well developed. Food processing equipment is provided from local dealers and there is also some manufacturing-design activity in the country. Concerning the distribution network in the domestic market there are some modern supermarkets and food store chains with new facilities. On the other side, it faces continuously increasing cost of packaging inputs (jars, cans) with simultaneous low quality standards provided from a weak package industry. In many cases companies have to import packaging material.

**Support structure** – The workforce is skilled and qualified coming from the 12 colleges providing food processing related training and the department of food processing in the University of Rousse. In addition there are some vocational training centers around the country.

The research infrastructure in Bulgaria is comprised of the following institutions that conduct research and provide services to the public and private enterprises

1. The Higher Institute of Food and Flavor Industries in Plovdiv
2. National Wine Research and Control Institute
3. Institute of canning industry
4. Institute of cryobiology and food technologies, Sofia

In terms of financing, in general it is hard to ensure credit and loans, with high interest rates and arduous processes. CARESBAC Bulgaria -is an investment fund providing micro credit and specializing in agribusiness and food processing industries.

**Firm strategy**- The sector is general is characterized as capable to follow international needs and look for higher quality of products in order to export in EU. The general attitude is towards use of new technologies as well as for using high skilled labor. Companies invest in the existing skilled human capital and provide additional training. Furthermore, some companies perform internal R&D or cooperate with other organizations especially in EU or other internationally funded programs.

**Demand**- In general, domestic demand for food products is in the low quality area connected with the general economic situation and cannot support the development of the sector. However, there is significant exporting activity (more than 15% of total exports and with very high figures in specific sub sectors) and in order to be able to compete in these markets companies have to introduce higher quality and new products, use of modern production techniques and use of marketing techniques.

**Government role** - A significant obstacle is the lack of funding for investment in new technologies that are of high need. Government support is not significant and at present there are few lending institutions. In addition companies refer to a continuously changing legal framework as well as to use of import restrictions and high tariffs.

### **4. What is the legal framework**

The most important parameter in the legal framework is the implementation of sanitary and veterinary control, harmonized with EU regulations that initially forced a number of enterprises to close down.

Tax law is following the industrialized country prototype but it does not provide support (tax exemptions) for reinvestment of profits for new technologies and production improvements that is necessary for the country.

Concerning the wine industry, the EU acquis will be introduced, concerning codification of wines and vineyards.

#### **5. What are the needs for innovation training of the sector**

There is expressed need by companies:

- d. for marketing training of managers
- e. management of new technologies.

A market mindset is considered as the most crucial to move the sector from a factor-driven to an investment-driven industry.

#### **6. Next Steps for ITCB**

Based on the previous description we can propose the following as priority actions for technology transfer in food and beverages sector:

- Promote projects for improvements of quality standards and hygiene requirements in private sector.
- Assess the areas of expertise of research establishment in the country and promote projects with the participation of local enterprises.
- Organize-support seminars with participation of business and academics concerning new technologies in the topics of supply chain management, quality assurance and control.

## B. FYROM

The food and beverages sector is characterized as one of **medium priority** for ITCB actions basically because of the absence of research capacity and the focus of any technology transfer activity in technology acquisition.

### **1. What is the TECHNOLOGY status of the sector**

The food-processing sector is considered as substantially developed. The main products being the canned and bottled fruits and vegetables, wine and beer.

**Fruits and vegetables** - The installed capacity for vegetables and fruit processing is 100.000 tones but the domestic raw material production allows for significant increase of production of frozen, dried and conserved vegetables. A very big share of the production is exported (95%).

**Wine** – Wine production is a traditionally strong sub sector. 16 wineries in the country are producing at this point and new investments are on the way. Technology is generally outdated as well as the wine producing techniques and no significant investment has happened in the country during the last years. An additional limiting parameter is the unstable quantity and low quality of grape production.

**Brewing** - There is also significant beer production from Bitola Brewery and Skopje Brewery with significant exporting activity. Both companies were privatized and plans for new investments are underway.

Relatively new (up to 10 years) technologies are used in all stages of the production chain-raw material handling (not specified), production, storage and marketing/distribution/sales. In addition, quality testing laboratories, quality control and total quality management systems are present in a number of companies.

### **2. What are the technology needs**

The major needs identified in the sector concern technology purchase for modernization of production lines concerning:

- a. raw material handling
- b. production technologies
- c. storage of products and marketing.
- d. quality control ranging from quality laboratory equipment to introduction of quality assurance and total quality management systems

Specific interest is expressed for automation technologies and computerization. In addition companies refer to reorganization of companies following international standards.

The companies also demanded greater access to information for new technologies in connection to access to the www and Internet services, networks for use in production while there was also reference to e-commerce and strong interest for CRM systems.

### **3. What is the Innovation Capacity of the sector**

**Firm strategy** - The companies in FYROM express a significant interest for introduction of new higher quality products with distinguishable label. The survey revealed a significant activity concerning new product launch as well as for modernization and automatization of production. The quality of employed labor is low with only 16% holding a higher institute degree. Companies perform very limited R&D internally and the common way of technology transfer in the sector is through equipment purchase.

**Support structure** - The research capacity of the country is limited and the only existing institute with potential to help the sector is the Institute of Chemistry and Biology. The Veterinary Institute of Skopje is also significant in the areas of sanitary control of animals and meat.

The weakness of the research capacity is evident from the very low consideration as a source of information for technology issues. The main sources of such information are through exhibitions and trade shows, suppliers and technology journals. The main barriers concerning acquisition of new technologies is funding availability and high import duties that affect cost.

A very interesting effort in the wine production subsector is the presence of the Royal Wine testing center, a product of Greek and FYROM cooperation, established in the municipality of Demir Kapija.

**Related industries** - There is a significant network of suppliers of equipment and machinery (imported) that offer this technology but very limited domestic production. Agricultural production is still a limiting factor for the companies both in terms of quality and quantity available.

**Demand** – Local demand does not offer development opportunities for the companies of the sector that has oriented itself towards exporting (more than 20% of total exports- 90% of wines). There is continuous pressure for new products and improved production processes to follow EU standards in order to improve marketability of products.

#### **4. What is the legal framework**

The only information provided in relation to the specific sector concerns the introduction issued a draft law on Health Requirements for Foodstuffs and Consumer Goods.

#### **5. What are the needs for innovation training**

Expressed needs from the companies were for management and marketing skills as well as new production methods in wine production.

#### **6. Next steps for ITCB**

Based on the illustrated picture priority actions for ITCB shall be:

- Promote the creation-improvement and support research projects in the Institute of Chemistry with the participation of industry.
- Support research cooperation in the area food quality as a critical parameter for the marketability of sector products.
- Consider cooperation in the area of wine production techniques in cooperation with the respective research centers and producers.

## C. ALBANIA

The food sector is considered of **low priority** from the study because of the low technology level of most sub sectors and the low appreciation of US and Greek technologies. However, the study also sees the sector as one of the most promising of the country in connection with the present agriculture character of the country.

### **1. What is the technology status**

The food processing industry is comprised of a big number of small enterprises - a result of the separation of big state enterprises to ease the privatization process - and very few bigger enterprises.

In most sub sectors – namely flour, pasta, cannery, tomato sauce, meat processing, alcoholic and non-alcoholic drinks technologies are very old and many tasks of the production are conducted manually. During the last years there has been minimum investment and in many cases old technologies are practically not usable. However, there are also few enterprises that have invested in modern technologies, use up-to-date production techniques and seem to be able to follow international developments and compete.

**Brewing-** There are three beer factories in Albania using old technology with the exception of a modern packaging line.

**Wine-** There is significant wine and brandy production in the country. Technologies are in general old and there is also problem of raw material supply quantity and quality. Modern facilities were established in Kantina, a distillery and winery with significant production and exports.

**Meat processing-** Meat processing companies are basically slaughterhouses and few sausage production units with limited production capacity. Technology used is more than 15 years old.

**Dairy industry** – There are 18 factories with small capacity and in general old technologies. However, recently new companies were created. AJKA JSK is a joint stock company with a significant capacity producing yogurt, cheese and other products and with the full range of production processes.

From the few modern facilities that were included in the study new technologies in the whole range of the production process were mentioned (raw material handling, production, storage, marketing/distribution).

### **2. What are the technology needs**

The major needs expressed from the companies of the sector concern the introduction of new modern technologies in raw material handling, production, storage, packaging, distribution and marketing. Especially material handling and storage warehousing are considered as the most important.

Specific interest is also expressed for:

- quality control and assurance systems
- new packaging technologies
- introduction of IT (networks, internet and e-commerce) in administration.
- Energy conservation or renewable technologies

### **3. What is the innovation capacity of the sector**

**Firm strategy** - There is a optimistic view for the prospects of the sector. Liberalization of the market and privatization have led to the entrance of new players and brought new

technologies and products. In addition, exporting activity has increased and there is an ongoing effort to improve quality and marketability of products. As such, it is expected that a more dynamic attitude will be adopted in the future.

**Support structure** – Private research activity is almost zero and the main technology transfer methods are technology acquisition and human resources training. The main research establishments in the sector are

- the Food research institute
- the Maize and Rice research institute with the recognition of the obvious synergies with the agriculture sector research organizations.

Higher-level education is basically provided in the Food-processing department of the Agriculture University of Tirana but there is no reference to vocational/technical training centers and programs.

In general, Albanian food companies do not have easy access to technology. There is no sufficient technology supply and transfer network and companies consider local unavailability of technology to be a significant barrier to modernisation. At the same time, financing is also a barrier to investment. Technology information is in general hard to obtain. The main sources are exhibitions and suppliers.

**Government support** - Government support for research comes mainly from the agriculture and food program. In addition it has withdrawn any import tariffs for machinery to help upgrading of technology.

#### **What is the legal framework?**

The country has introduced a liberal commercial policy with respect to exports and imports of agriculture commodities and inputs for the food processing industry. In the survey, the companies mentioned the need for improvement of the legal framework in the industry without specifying.

#### **What are the needs for innovation related training**

Needs for training, as derived for the study, refer to:

- i. technical skills for new production methods
- ii. marketing

#### **Next steps for ITCB**

Based on the given picture, the basic conclusion is that the research capacity of the country is limited and the main innovation path is the acquisition of new technology and technology transfer. It is therefore important to focus and strengthen technology transfer activities and also promote research cooperation for specific projects of direct connection with industry especially in the area of quality control and assurance.

More specifically

- Promote a project for the creation of technology information database (IT application) concerning modern food technologies and processes.
- Assess the opportunity for research cooperation in the area of quality control and assurance and promote seminars, conferences or training workshops in the introduction of quality management systems.

## D. Romania

The study characterizes the Food sector as one with **high technology transfer** opportunities based on the low current technology status of the companies and competitiveness and the growth of demand that is expected for the coming years.

### **1. What is the technology status of the sector**

Food and beverages industry is a very important industrial sector, producing 10% of the GDP and more than 15% of the total industrial product of the country. In total, technology status in the country is low, characterized from old equipment and very low automatization, underutilization of capacity connected with the decline of agriculture production during the last 10 years and low final product quality in comparison to imports.

The main sub sectors are:

- **Edible oil** - Activity is limited to production of oil from sunflower seeds and soybeans. Refined oil and margarine production is very limited and below international standards leading to significant importing to cover increasing demand.
- **Meat processing** – Because of the decline of livestock production the sector is facing significant underutilization of capacity, which is old and inefficient. The products are of lower quality compared to EU standards.
- **Dairy products** – The dairy industry production is focused in cheese. The decline of livestock has affected milk production and companies underutilize existing capacity. In addition, higher quality milk is not produced and a growing demand in the country is fulfilled almost exclusively by imports. In general quality of products is lower to the respective imported products.
- **Fruit processing** – The sector used to be significantly strong before 1989. However, a number of parameters have affected its competitiveness. High price of low-quality raw material, low utilization of capacity (28%), low quality of final product and the use of old inefficient technologies are significantly limiting the opportunities of the sector.
- **Brewing industry** – There are 34 manufacturing companies with a total capacity of 14 million hectoliters. In the sector there is significant competition from imported products and the basic problem is the limited supply of raw materials as well as the lack of product quality control.
- **Wine industry**- Wine production is an important activity in the country and Romanian wines are increasingly getting recognition in the international markets. The major constraints are the low quality of grapes that leads to production of wines of the low price segment or in bulk exports. The wine producers can be separated in two basic segments, the low quality producers –formerly stated owned enterprises or international traders- and higher quality international boutiques that own vineyards and focus on higher quality wine for export. The latter are using modern methods in all stages of the production process - counting on the fact the high quality wines are connected with abundance of working hands. Still, the industry shows productivity rates around 50% of EU average.



## **2. What are the technology needs of the sector**

The major needs for the food sector of Romania are for new equipment and technologies to modernize production in almost all sectors and all production phases responding to the status described above.

More specific interest was expressed for:

- manufacturing of micro-installations for fruit juice
- vegetable processing and canned vegetables
- creation of a pilot station supplying biological preparations to dairies
- food packaging systems and equipment for canned vegetables, fruits, and meat, for dairy products as well as for the sugar and edible oil industries, beer and fisheries.
- Quality control systems (HACCP, ISO 9000)

## **3. What is the innovative capacity of the sector**

**Firm Strategy** – The picture given in the study is quite controversial. Firms show significant interest in technological developments but, mainly due to financial constraints, they do not invest significantly in R&D (the number of researchers in enterprises has reached zero in 2000) and the creation of new products. They rely mostly in internal technical expertise and do not cooperate with external partners –although this may be connected with the capacity of these. In addition, the main interest is directed towards new equipment and investments in the turn-key form rather than cooperations and joint ventures.

**Support factors** - On the other hand labor in the sector is quite skilled and there is also significant support structure training in the vocational, high school and post-high school level and upward trend in the number of higher school graduates in the sector.

The main relevant research organizations are:

- the Institute of Food Chemistry and
- the Fish processing research institute.
- Central Research Station for Tobacco Culture and Processing, Bucharest
- Research institute for food processing and refrigeration industries

In addition, a big number of the agriculture related research centers are involved in the agro-processing thematic areas. Research activity in the sector is following very steep declining trend and research expenditures have decreased more than 75% during the period 95-99.

**Demand** – The low purchasing power of the Romanian people is a limiting factor in demand for higher quality products. However, EU accession, privatization and increased competition are already forcing for higher quality products and many companies are looking into exports as the opportunity area.

**Related industries**- Another important barrier is the lack of appropriate packaging (improved hygiene/quality standards and product profile) supply in the domestic market. At this point, despite the establishment of some packaging enterprises, demand is not covered and imports of packaging material have increased significantly. Local producers do not have modern facilities and level of automation. In terms of distribution, there are is no strong distribution networks and food is mainly sold through. Another negative parameter is the inefficient connection of the food processing sector and the agriculture (raw material) small scale producers.

**Government** role- The government support policy is mainly expressed through the Enterprise Support Fund – funds coming from the EU PHARE Program- for new product development and improvement of safety and quality standards. In terms of support measures, the government uses in periodic bases import duties to support domestic production.

#### **4. What is the legal framework in the sector**

The main driver for the industry -in terms of legislation – is upgrading of quality and hygiene standards to the EU level to allow penetration in the EU market. At this point the chapter is still open and there are still significant gaps affecting the marketability of Romanian products.

#### **5. What are the needs for innovation related training**

Companies refer to an extensive need for marketing skills to improve tradability of products and exports. In addition, the low starting point of existing technology points to the need for technology and innovation management.

#### **6. Next steps for ITCB**

The picture described directs towards a set of priority actions:

- Contact research organizations, assess their capacity and examine their interest for specific research projects
- Given the strong interest for technology acquisition as the prime technology transfer method support technology management and transfer training programs
- Assess in greater detail the financing opportunities in the particular sector.

## References

In addition to the studies and data provided from the companies we also used the following supporting documents for each country:

### **Bulgaria**

1. Diana Kopeva, IME, “Competitiveness of the Bulgarian food industry”, 1998, <http://www.ime-bg.org>
2. Borislav Georgiev, IME “ Competitiveness of the Bulgarian wine industry”, 2000, <http://www.ime-bg.org>
3. Diana Kopeva, IME, “Canning industry”, 2000, <http://www.ime-bg.org>
4. Bulgarian trade and promotion agency, “Agriculture and food industry”, [http://www.bepc.government.bg/industry\\_en.html](http://www.bepc.government.bg/industry_en.html)

### **Albania**

1. Food processing in Albania  
<http://www.mac.doc.gov/eebic/countryr/albania/food.htm>

### **FYROM**

1. Royal wine testing center, <http://www.rbwtc.com.mk/contents/Center/Index.htm>

### **ROMANIA**

1. Evanston Capital Advisors, The global opportunity for the Romanian wine industry
2. Factbook 2000, “Romania – Food processing and packaging market”,  
[http://www.factbook.ro/countryreports/ro/Ro\\_FoodProc&Pack\\_MktAssess.htm](http://www.factbook.ro/countryreports/ro/Ro_FoodProc&Pack_MktAssess.htm)

## **APPENDIX F: Studies on Information Technologies**

# INFORMATION TECHNOLOGY

## 1. Analysis of the Information Technology sector

The information technology sector, as analyzed here, comprises of computer hardware and software development and customization; production and distribution, Internet service and content provision; design, supply, and integration of information systems' technical infrastructure, systems integration, consulting and maintenance.

### D. BULGARIA

The analysis of puts a **high priority** mark in the IT sector, based on the presence of a relatively strong knowledge and production base and the significant gaps in technology dissemination and transfer tools. In this respect, the study points out to the direction of cooperation schemes with significant local content rather than direct investments.

#### 1. What is the technology status of the sector

The total IT market in Bulgaria in 2000 was 190 million USD with higher growth rates realized in the software applications and services part sub sectors.

In general, the IT sector is updated, and companies use technologies of less than 5 years age. In most cases they are even less than that. Furthermore, the sector has also managed to create its own outputs and move towards the production of new products. However, the products are based on a customization/localization approach to meet domestic market needs in lower costs.

In terms of more specific categories of IT technology use we can categorize as follows:

- **Hardware** – The total size of the market is around 160million USD. PC ownership is low (4.1 per 100 inh –0.5 at home and 3.6 in business – 2000 data) and PC purchases are in the business sector. The production of hardware is split between domestic (60% of total PC purchases) and foreign assemblers/manufacturers. Domestic production is only assembly using imported components and cheaper labor and it is mainly targeting the low-end (price sensitive) market segment. Higher technology equipment is imported, mainly from US. Hardware assembly and production companies use a moderate level of quality production and supportive equipment imported from the US. The peripherals market (printers, scanners, modems etc) cover 15% of the market.
- **Software** – Depending on the type of the enterprise, the various types of software applications used vary from Operating systems, Network support, software developing, development tools (CAD etc), enterprise resources management tools Database systems are less widespread. Another segment that is developing recently is the software security services.

The total size of the market is around 17million USD, from which 10 million is imported and the remaining produced from local software developers. The increase of imports is connected with the government fight against piracy that has increased demand for authorized software packages. The local software – including internet software - production is mainly targeting smaller enterprises and has a customization – localization of imported products nature based on language and specific needs approach.

- **Internet** – Internet use from companies is widely spread mainly as an information-providing (one way) tool. Interactive services are not widespread and e-commerce is extremely limited, due to the limited use of credit cards in the country. In reference to

the general population internet penetration is low (5.3 users/100inh) and connected with the limited PC penetration and the relative high prices for internet connection. At this point internet cafes serve as the main public access gateways. The problem is more acute outside the main urban areas, where access to internet is hard to get. There is a big number of Internet Service Providers (200) of small size that are expected to consolidate in the future. Access is provided through dial-up, leased lines, xDSL, ISDN.

- **E-business:** E-commerce is still in its infancy in Bulgaria, mainly because of the very limited use of credit cards from the general population. However, the basic infrastructure exists (electronic payments system, internet shops, e-advertising) and e-commerce is expected to develop significantly in the future. .

- **E-government:** Bulgaria scores high in the provision of electronic government services that go far ahead from information provision. However, the basic limiting factor is the low accessibility of Internet to the general population. Online services are still very limited but there are future plans in this direction. The country is placed in the laggards group (rank 48, Greece 28) concerning e-readiness, although ranked higher among the other ITCB countries and close to the more advanced group of countries. 90% of ministries have a web site and some of them have moved on step further than only information provision (document download). In addition 20% of regional authorities are also present on the web.

A very interesting parameter is the high level of concentration of IT activities in the Sofia (more than 50% of turnover) and Plovdiv (11%) areas, while there are other remote areas with negligible IT activity and production.

## **2. What are the technology needs and opportunities in the sector?**

In terms of technology needs in the country, a number of existing studies point to the following major areas:

**Hardware** – There is high need for continuous upgrade of PC systems and servers plus security hardware and network equipment. In addition various high end computer peripherals (laser color printers) are in demand. In the manufacturing-assembly side there is increasing need for measuring and testing equipment and various instruments for quality check of assembled products. In addition, reference is made to introduction of quality management systems, going beyond quality control.

- **Software** – Continuous upgrading of software tools and increase of available software applications are expressed from all companies. Specific focus was given to security software and copy protection applications. In terms of software development there are also needs for quality assurance systems and control. There is also need to create a quality certificate that will be recognizable and would act as a quality label for IT products in the Bulgarian market.

- **Internet** – Most companies point to the need for web site design and authoring improvements that will provide the basis to move towards more sophisticated web applications and e-commerce. Needs are expressed for business functions applications such as e-ERM (enterprise resources management) and e-CRM (consumer relations management) and other internet based applications covering the whole range of business activities.

In terms of opportunities in the sector there are specific areas with increased interest and growth potential:

- The development of modern information systems in Government and regional administration, the National Social Security System, the ministry of finance and the medical insurance bureau provide opportunities for

significant investments plus additional supplementary- complementary services.

- The increasing need of PCs and peripherals provide opportunities in the subassembly sector.
- Quality assurance/management systems and certification services in software and hardware development.
- The present existence of low quality transportation systems provides opportunities for IT applications in the area of telematics, telemedicine etc.

### **3. What is the capacity of the sector for innovation and technology transfer**

**Support structure** - One of the strongest assets of Bulgaria in IT is the presence of an advanced human capital. Based on strong tertiary education in IT there is abundance of high caliber IT specialists. At this point supply is exceeding demand in some sub sectors. The lack of job positions and the low wages offered intensify the phenomenon of brain-drain (especially towards US and UK) that is depriving of the highest-caliber scientists. Research activity covers many areas of IT technology though a number of IT research centers:

- Institute of mathematics and informatics
- National laboratory of computer virology
- Institute of computer and communication systems
- Institute of information technologies
- Laboratory of parallel processing

After the dismantling of the Centrally planned system of the Soviet era, the connections of research activities and application- implementation was lost, directing research mostly towards theoretical paths. At this point there are continuous efforts to strengthen technology support services, increase financing sources and improve technology transfer and adoption of high tech. Such institutions are the ARC Fund and Business Innovation Center-IZOT, with particular focus on IT. In addition, the latest development of IT has led to the creation of a number of private IT market research firms and consulting firms. There are also 6 international IT related technology fairs organized every year in the country.

Weaknesses can be identified at the areas of technology exploitation and commercialization. Lack of financing resources both to acquire technology and to support new ventures, as well as marketing and technology management skills are limiting both the supply and demand for IT growth.

In terms of business support for technology transfer and development, the most important supporting services to be mentioned are the 6 free trading zones that allow free tax and VAT for exporting production.

Borrowing cost from the streamline sources is relatively high with high interest rates and request for collateral. However, there are also international funds and financing firms offer capital, loans and equity investment to small and medium size enterprises in lower cost.

**Firm strategy** – Local producers are at this point mainly directed towards customization and localization of imported products to the Bulgarian market. Own product development is very limited but there is a positive attitude towards adoption. of new technologies. Cooperation with research centers and among companies is limited in general and competition is mostly price based and added-value based.

**Government support** – The government has set IT development as one of the first priorities-targets for the country. The creation of a High Technology Park is considered as one of prime importance. Intentions have been expressed but there is no appropriate legal framework yet and the necessary organizing expertise. Increase of IT use in administration and public services is also pursued as well as IT in education in order to improve the IT skills of the general population and increase IT use.

**Demand** - The main barrier to further development of the IT sector is the economic status of the country and the limited demand of IT services in the other sectors of the economy. At this point, government projects absorb the largest share of the market. European Union support programs during the accession procedure will create additional demand. However, a longer-term development of the sector requires independence from government support. At this point, demand in the private sector is connected with the general economic conditions and trends.

#### **4. What is the legal framework**

A very significant and country specific problem is intellectual property rights protection. Despite the existence of a well developed regulatory framework, extensive software piracy and illegal software copying is widespread. At this point the Bulgarian government is working towards streamlining the current legal framework with the EU legislative framework. The effectiveness of the enforcement measures –not very high in the past - is a very important parameter.

Concerning research, new legislation provides more freedom and space for own decisions to research centers and research institutions. There are specific acts concerning high-tech activities and promoting high-tech research. At this point, the legislative framework for High Technology Centers focused towards the market is under consideration.

In IT related legislation, EU accession is a significant driving force and pressure factor for the creation of a more coherent and necessary legal framework. Concerning e-commerce, the creation of the legislative and standardisation basis and the related instruments (customs, tax) and introduction of electronic payments till 2002. Electronic document and electronic signature act is also prepared for implementation. In general, though, legislative work precedes actual enforcement ability, especially in the IT related issues where, in many cases there is lack of public servants expertise.

#### **5. What are the needs for innovation training of the sector**

For the Bulgarian IT sector, the most crucial needs concerning innovation are not related to technical skills, but improving managerial and marketing capacity to improve the performance of the companies and, ability to improve marketability of penetration of IT products and better understanding of market demand.

#### **6. Next Steps for ITCB**

The report highlights a number of priority actions for ITCB:

- Create contacts with IT research centers in Bulgaria, identify research cooperation interests and competences and promote cooperation in the research FP6 of EU.
- In the developed projects, promote a strong technical role of the Bulgarian partner and focus on the transfer of marketing, management experience from the US/Greek side/partner.
- Organize/support training courses/seminars/workshops/activities in the areas of technology management and innovation management tools.
- Promote projects of high-end nature especially in the underdeveloped area of e-commerce, software and data security.





## B. FYROM

According to the study the IT sector is of **low to medium priority** for ITCB cooperation and technology transfer. This is based on the limited research capacity in the country as well as on the absence of significant production activity in the country.

### **1. What is the status of the sector**

In contrast to Bulgaria, in FYROM there is no significant IT production activity. The overall level of the IT sector in FYROM is low. There is no significant original production activity both in software and hardware sub sectors –most companies are traders, distributors or small assemblers - and IT development at this point is driven from government projects supported from international programs and sponsors, while the remaining market is small. The existing IT category listed companies offer services in software, hardware, Internet and multimedia without specialization and more than 85% are very small (up to 20 employees). The dominant sectors are networks and integrated solutions services, while there are few e-commerce specialized companies.

The technologies used are:

- **Hardware** : Mainly PC systems and servers. PC penetration is only 3%.
- **Software** : Common/ basic software programs for operating systems, office automation, databases, graphic design, development tools.
- **Internet**: A significant percentage of IT companies have web site providing contact information and few of them move towards e-commerce applications. Internet penetration in 2000 was around 2%, showing a limited demand for web connection. The limiting parameter for e-commerce is the small size of the market and the limited use of credit cards. Still, a number of e-commerce sites have been established and an increase of e-commerce customers has been registered during the last years.
- **E-government**: E-government is very limited. 70% of the ministries have a web site –providing only basic information and only 4% of regional authorities. There is a very small part of the government sector that provides services on the web. The range of services provided is extremely limited.

### **2. What are the technology issues and needs**

Demand can be separated in two basic categories:

- Additional already existing, described technologies or upgraded versions
- New modern technologies and IT applications. These include more sophisticated software applications, integrated software solutions, business applications and wireless technology. There is also significant demand for e-commerce applications and network technologies to decrease costs in the supply chain. Companies also request quality assurance and control technologies and management systems. In manufacturing, IT applications such as CAM, CNCM and RCM techniques are proposed.

### **3. What is the capacity for innovation of the sector**

In terms of innovation and innovation support capacity we could say that the country lacks at this point the necessary resources and knowledge to develop its own strong IT base.

**Support structure** - During the latest years significant attempts have been made to increase IT literacy and in general the country is considered as improving its population general literacy level as well as IT literacy.

Concerning R&D activity, it is limited. The basic IT research center is in the Institute of Computer Science under the department of Electrical and Electronic Engineering in the University of Skopje and the respective department in the University of Bitola. Note should also be made to the plans for a Regional Education and Technology Center for Informatics and Information Technologies.

In terms of intermediary technology transfer mechanisms and institutions there are no such organized schemes. Such a role is undertaken by the Chamber of Commerce, that serves the full range of FYROM enterprises. The main technology cooperation points are suppliers and exhibitions (1 international trade fair) , shows and similar events, pointing again to the turn-key approach for technology upgrade. Another service helping innovation dissemination in the Technology Watch center that provides information on patent documentation. At this point, there is discussion concerning the creation of High Technology Parks as areas of high R&D activity, as well as the creation of incubators for new business support. In terms of innovation promotion, note should be made to the existence of 3 Free Trading Zones created to attract foreign investments in computer hardware manufacturing.

A significant problem of the sector and of any innovative activity is the financing part. Both because of the small size of the market and of the current conditions in the economy, it is difficult to find financing for investment.

**Firm strategy** – The innovative capacity of companies is very limited. The most common method for technology transfer is technology acquisition, while there is limited technical expertise for service and maintenance, pointing out the absence of IT experts and limiting the adoption/localization capacity of the sector. In terms of skilled labor, a very small percentage (2%) of the IT enterprise personnel hold graduate degrees while around 50% have undergraduate degrees. IT companies express significant lack of technical expertise.

**Demand** – At this point demand for higher IT services is limited and it is mainly based on the government sector. The market is small and financing of investments is still hard. As such there are few opportunities for innovative products with the exception of few small businesses that are looking for advanced IT solutions.

**Government support** – There is no comprehensive government strategy yet. The national committee for IT created recently shall change this in the future. International, EU programs are the greater driving-pushing forces for sector development. E-government is still in its infancy in the country.

#### **4.What is the legal framework**

The legislative framework does not cover effectively the areas of computer technology, know-how and software. Even for the existing legislation, enforcement is very weak and only lately has the government undertaken additional measures.

Concerning high tech research activities a technology park establishment law is promoted and in general there is willingness to provide greater flexibility to research activity utilization.

#### **5. What are the needs for innovation training of the sector**

At this point there is significant gap of technical skills. Training is necessary in IT (especially software) development. At the same time, given the strong role of technology

transfer as the main strategy for upgrade, it is necessary to provide technology management/transfer skills.

#### **6. Next steps for ITCB**

Based on the picture illustrated the most appropriate strategy-measures for ITCB in the sector would be to:

- Support IT and technology management training events.
- Supporting the creation of a competent IT research and technology center/institution (regional research for informatics and IT) through joint projects.
- Project for a high-technologies online database with the potential to be transformed to an e-commerce marketplace.
- Support/promote private sector IT investments-establishments in the region.

## C. ALBANIA

The study characterizes the Albania IT sector as one of **high priority** for ITCB based on the extensive needs of the country in almost all areas and the fact that the country is getting into a growth period. However, because of the absence of data, (sample size was 2 companies) there is no detailed evidence on the actual level of the IT sector.

### **1. What is the technology status**

The Albania IT sector is comprised of small- medium size enterprises (less than 50 employees) whose major activity is distribution and in a lesser degree purely basic assembly activities. The size of the IT market is 1.2 million EUR. At this point the supporting infrastructure is not sufficient to allow for significant growth of the IT sector. Albania is graded very low in all e-readiness parameters.

**Hardware** – PC penetration is 0.12/100 inh (Greece 10.7) with relatively slow growth rates. There is no local production activity and the hardware sector is basically limited to trade and distribution role.

**Software** – Software applications cover operating systems and databases. The absence of property rights protection enforcement allows for significant software piracy levels and decreases significantly profits for sellers and distributors but at the same time it is an IT skills creating industry.

**Internet** – Internet use is very limited (0.3 users/1000 inh compared to 70 for Greece). There are 13 ISP at this point operating in Albania and the professional users penetration is low. Internet hosts are 1 for every 13000 inh, a much lower density than any other ITCB country. A very significant limiting parameter is the low level of telephone density (5 lines/100 inhabitants).

**E-commerce:** E-commerce does not exist in Albania and the prospects for the near future are very limited connected with the absence of credit card use in the country. In addition, the telecommunication law sets limits in commercial networks. At this point, commercial Internet Services scheme is progressing in a not-for-profit form.

**E-government:** At this point electronic services are non-existent. Albania public sector has a low usage level of internet (60% of ministries have a web site with slow growth rates and very few other public sector services) and they are limited to information provision, limited publications and very few and basic databases.

### **2. What are the technology needs of Albania in the sector?**

The need-demand of the IT companies is limited by the low awareness and information of existing technologies as well as the absence of demand from a weak industry. It is expected though that gradually demand for more complicated services will increase.

**Hardware** – Companies express high needs for PC systems, peripherals and other basic-medium level technology, both in production and other functions.

**Software** – A very important need for the country sector is the availability of software applications in Albanian language. In addition there is expressed need for upgrading the existing software applications as well as to use quality control and quality assurance systems in production. The provision of integrated solution software for companies is expected to rise in the future.

**Internet** – At this point, the most critical parameter is the availability of connection to the WWW, related to investment in infrastructure. The demand is basically for information access.

### **3. What is the innovation capacity of the sector?**

**Firm strategy** - In terms of innovation capacity, at this point there is significantly limited knowledge base. Albania companies in general are very small, with few IT trained employees and limited R&D activity.

**Support structure** - The main method of technology transfer in the country is through suppliers and trade shows/exhibitions for direct turn-key investments. The absence of specialized personnel for maintenance and service is a significant barrier to foreign technology purchase. In addition, there are no specialized company support services (consultants) to help in the integration of IT in business.

The main research body in the IT area is the Institute of Informatics and Applied Mathematics (INIMA). INIMA has a local area network and it is the starting point for all IT activities in the country.

Financing is a strong barrier to technology transfer and at this point there is no special arrangement/legal framework to promote IT foreign investment. The Albanian Economic Development Agency is a supportive organization for investment support in the country. There is also a number of internationally funded support programs (World Bank, UNDP, EU, Soros foundation) that attempt to enhance the information exchange support structure and network information sources.

**Government support** – The government does not have a clear strategy concerning IT, information society and e-commerce and a number of obstacles for the development of the IS are presented. Some positive measures concerning IT, was the elimination of duties on a wide range of IT products covering more than 95% of the market. In addition the government is moving towards the creation of an SME supportive legal framework although financial incentives are expected to be limited.

### **4. What is the legal framework?**

Patent law and intellectual right protection have been established. However there are significant enforcement problems, especially concerning software market piracy, which is widespread, but should be attributed to the fact that original copies are too expensive to purchase. There also exists a free trade zone legislation that has not been implemented yet.

### **5. What are the needs for innovation related training of the sector?**

Given the absence of IT trained personnel in companies and public administration, it is important to increase the IT related training programs concerning both IT use, as well as software development. In addition, training should be provided in the areas of service and maintenance, referring to hardware and networks, as it is a main barrier to technology transfer investments for all companies.

### **6. Next steps for ITCB**

It is evident that the country does not have any significant advantage in the area and that the IT sector is very limited. In addition information dissemination and availability of networking activities are limited. This picture points out towards a specific direction of actions:

- Support training programs that provide IT skills.
- Support projects that increase Internet availability -accessibility.
- Support networking projects with participation of the Research and education institutions in the country (most probably INIMA).
- Support a project for the creation of national portal with business information and technology databases.

## D. Romania

The IT sector of Romania is characterized as of **medium to high** technology transfer prospects based on the existence of a significant knowledge and technology base in the country, the high level of human capital and the development of the sector, limited by the low level of the economy, the presence of a number of multinational dominating the country and the low innovative capacity/activity of the domestic companies.

### **1. What is the technology status in Romania**

**Hardware** – The total size of the local market in 2001 was \$250 millions. Prospects are for 10-15% growth for the next years. Very important driver of the hardware market are the government projects for Information Society, since the country is still in need for huge investments in order to bring itself closer to EU levels.

The local manufacturing activity is significant covering around 45% of local demand. It is mainly focused on assembly of imported equipment. It includes both PCs, PC parts as well as servers, peripherals and networking equipment. There is also some own equipment manufacturing activity and the country. In addition to the domestic companies some multinationals have created production facilities in Romania. However, at this point the main focus of the sector is towards subcontracting and its competitiveness is based on lower labor costs. PC penetration is relatively low (3.2/100 inh) and even in business PC use is around 30% of the total sector, in direct correlation with the high cost of PCs.

**Software** – The software market is growing very fast in the country and the local industry covers around 25% of it providing all range of services including business management support. In 2001 the total software market size was around 100 million USD. At this point, the typical Romanian software company (more than 3500 in 1999) does not have more than 10 employees and most of them are founded for former researchers in public research centers or IT graduates.

The services/products offered are mostly customization of imported programs for SME, local content, anti-virus software as well customized solutions for accounting that adhere to the national requirements. At the same time, the trend in the market during the years is towards imported ready-made packages and usually small IT firms are limited in customization work and not own solution development. On the contrary, the software distribution industry is growing based on increased demand and sales of imported packages. There is also a small number of bigger firms – with some type of foreign connections – that offer a whole range of software and internet services.

**Internet** – Internet growth in Romania follows the general world trends. Internet penetration is growing fast although starting from a low point (3.1/100inh) – a limiting factor being the small number of PC penetration at home, leading to internet use in public areas. Internet use in business is increasing. Concerning IT services they are mainly focused on Internet Service Providers that were more than 200 in the country, but connection quality is low.

**E-commerce** - Concerning e-business, at this point it is limited, the determinant factors being low Internet access, high cost of IT services and very limited credit card use. In addition the low quality distribution network decreases reliability and trust to effectiveness of electronic transactions. At this point there are 10 B2B sites and 25 B2C. Electronic banking and Internet banking are expected to emerge soon, in connection to developments in the clearing system for payments methods.

**E-Government** – The government is moving fast towards a number of e-services. At this point the services are limited in information provision but there is a number of projects

underway to move towards interactive services. In 2000 62.5% of national government agencies had a web site, while the percentage was lower than 10% for local and regional agencies. Added value e-services to be delivered are e-tax, e-procurement etc.

The e-readiness indicator prepared for the Economist Intelligence Unit ranks Romania in the laggards group (rank 52, Bulgaria 48 and Greece 26). The country is considered in the very early stages of e-development.

## **2. What are the needs of Romania in the sector?**

The study did not give specific-detailed information on present needs and opportunities in the IT sector.

It can be derived, that demand for software is growing steadily in high rates although demand for basic hardware (PCs, servers, peripherals) is still getting the largest share of the IT expenditure.

Software demand is focusing on standard software solutions; client/server solutions and Enterprise Resource Planning with the important parameters for the local producers of the needs for local content and local interface of various software applications. IT services are in great demand from the companies now trying to catch up with the latest developments in the international market. Although e-commerce is still considered problematic, there is belief the B2B services shall experience significant increase in the near future.

In terms of needs of the software production sector, great need is expressed for software quality assurance, testing and management systems and tools in order to verify quality and improve market position.

A list of needed IT services/products in Romania that are in top of the demand list include:

- Advanced performance hardware equipment (desktops, laptops, servers, peripherals)
- Advanced software for back office operations, process control, data management, enterprise management systems, sales and marketing
- Network operations software
- E-government services and applications
- B2B electronic commerce and supporting software applications (security, internet software)

## **3. What is the innovative capacity of the sector**

**Firm strategy** - At this point, the strategy of most companies is based on localization of imported products and adoption of technology, rather than own products development. The companies themselves consider that their innovative record is low and believe that their strengths are their technical skills and experience. The small size of most companies reduces their financing capacity and the ability to move towards new products. On the other hand, their products are based on a customer base and their core competence is to adjust products to specific clients.

Concerning human capital base, companies utilize the high caliber personnel available in the country. In most IT sector companies the big majority of the employees hold higher degrees although not a big percentage holds a PhD (research level) degree. In addition, additional training is used from a big range of companies.

**Support structure** – One of the most important parameters concerning the support factors for the IT industry is the very strong human capital base. With 97% literacy rate, universally acknowledged IT higher institutions and 5000 ICT graduates every year, the country has the fundamentals for IT development. At this point, supply of IT trained



persons is exceeding demand and the problem of brain drain towards Western Europe countries and US is very acute deducting the best-skilled percentile.

In terms of R&D infrastructure in the country there is a significant number of public and private institutions conducting basic and applied research in the area. It includes research centers focusing in various IT sectors, plus laboratories in the big number of universities in the country. Some of those are:

- National institute for R&D in Informatics (ICI)
- Building design, research and software institute
- Research institute for informatics
- Computers department in the polytechnic university of Bucharest

There is an increasing effort to connect present research activities and create a broad R&D network in the country through virtual and actual links. A big number of these institutions have also participated in a range of EU supported programs. In addition to public research centers, private multinational companies such as Cisco and Microsoft have established their own research activities in the countries and have created close cooperation ties with the national research centers.

Concerning technology transfer, there is a significant government program concentrating towards technology transfer and dissemination of information. Technology transfer structures have been created in the country, coordinated from the National Agency for Technology transfer and innovation, including the:

- National Innovation Institute with 5 regional centers
- Centers for Innovation and Business (8)
- Industrial liaison offices (12)

The companies in the study refer to increasing creation and utilization of linkage services.

**Government support** – The government has created a group for IT promotion under the supervision of the ministry of Communications and IT. The general goal is to place Romania in the international information society and support all those parameters that will make Romania a Black Sea hub for IT. The government is also intending to strengthen the export performance of the IT industry, especially software, for a wide range of products. Research expenditure is decreasing lately due to the economic hardship but it is expected to increase with additional support coming from the EU research funds. R&D government expenditure in IT for year 2001 was US\$75 million. In addition, the government has created tax exemption provisions for R&D activities, intending to create incentives for R&D activity.

The government plan concerning technology transfer and innovation attempts to address/strengthen all the necessary parameters including research support, creation of stronger linkages and collaboration, support technology transfer services, increase funding opportunities etc.

**Demand** – Demand for IT services is already experiencing significant growth rates in almost all sub sectors and it is expected that a number of companies will move towards higher value services. However, at this point, demand is dominated from government plans while the private sector is less dynamic.

#### **4. What is the legal framework**

The responsible authority is the Ministry of Communication and Information Technology. A very acute problem is high level of Internet fraud (4<sup>th</sup> in the world) and the extremely high level of software piracy – Romania is in the top list of software piracy countries. The relative legislation exists but there is weak enforcement.

Concerning e-commerce, lately a law establishing rules for electronic signatures and other legislation provisions are intending to set the proper environment. However, changes are taking time to be implemented. The major driving force is the status of EU accession country, which is pushing towards a faster adoption of different innovation support measures in coordination with EU policies.

The government is also intending to change R&D related legislation, concerning researchers status, intellectual property as well as R&D centers competition.

### **5. What are the needs for innovation related training**

Concerning skills, it is evident that the country has a substantial knowledge base that it is expected to improve even further in the future. Government plans and private initiatives are moving towards this direction. On the other hand, there is gap in management and marketing skills, the ability to promote innovative products and to integrate them in the companies.

### **6. Next steps for ITCB**

The conclusions of this study are that the IT sector in the country has significant growth potential. However, at this point, it is evident that its competitiveness is low and imports in the form of ready-made solutions are expected to increase in the future, leaving the local IT companies with lower added-value activities and services. Given the high skilled labor available in the country, what is missing is the ability to transfer the outcome of research to industry. The proposed steps – priorities for ITCB activity should be to:

- Identify the competent R&D players and promote cooperation in projects-programs that target-utilization of research results through cooperation with private companies. Potential fields of activity are e-commerce applications, online databases and software security.
- Attempt to include Romanian private and public organizations in EU partnerships under the FP6 program; Interreg III and other EU supported programs.
- Enhance projects with strong local technical content use and simultaneous training in the marketing and management aspects.
- Support technology transfer – innovation management training events, training programs as well as conferences and seminars.

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## **APPENDIX G: Studies on Telecommunications**

# TELECOMMUNICATIONS SECTOR

## 1. Detailed analysis of the sector

The sector is comprised of telecommunication (voice, data, video) services providers and network operators, telecommunications (network, transmission and reception) equipment and components as well importers wholesalers and distributors.

### E. BULGARIA

The telecommunication sector is characterized by the study as one of **low to medium priority** for cooperation in this sector because of the limited size of the local market. However, the picture given concerning the sector is that it is dynamic with high potential.

#### 1. What is the technology status of the sector

The general picture of the telecommunications sector is that is quite vibrant and keeps close to international developments. The telecommunications technology used is advanced since in most cases it is less than 5 years old and there is a continuous process of upgrading. It seems that the main parameter is the growth of demand from the other industrial sectors that are not moving with the same speed.

#### Basic statistics

Conventional fixed lines: 35.7 per 100 inh (2000)

ISDN lines: 0.5 per 100 inh (2000)

Mobile lines: 8.2 per 100 inh (2000), 330000 subscribers

Network digitization: (2001) 14%

Cable TV: 20% penetration to Bulgarian population

Fixed operators: Bulgarian Telecommunication Company (monopoly until December 2002)

Mobile operators: 2 (liberalized market, state licenses)

Public pay phones: 30000 / 3.6 per 1000 inh (1999)

#### Telecommunication service providers and network operators

Several advanced technologies exist in the backbone side as well as in the subscriber side:

- ISDN has been introduced although penetration is low
- Digital backbone system and Digital Subscriber lines
- Frame Relay, Asynchronous Transfer Mode and Fiber distributed Data Interface technologies are already used for broadband wide-area networks
- Network management and maintenance systems including use of GIS for spatial information.
- Transmission equipment locally produced or imported as well as optic fibers.

The following description gives an indication of the level of advancement in the area of telecommunications.

**Fixed networks** – The PSTN (Public switch transfer network) has 3 million lines (2001) with a low digitalization level (14%.) in the local level and 95% of the long distance

network. ISDN (40000 ISDN lines were installed by the end of 2000) and xDSL technologies have introduced during the last years providing high speed connections. Beyond X.25, Frame Relay, ATM and Fiber distributed Data Interfaces are used as backbones for broadband networks. VSAT is also used for satellite communications. In addition, the use of network management and maintenance systems integrating GIS technologies are mentioned. Other technologies reported are Channel Service Unit/Data Service Unit digital devices. In terms of equipment, the whole range (transmission, routing, bridging, cables, etc.) is used, either locally produced or imported. BTC has an ongoing network-upgrading program that includes deployment of optic fibers, SDH and introduction of a range of services for high speed connections for special customers (e.g. VLAN)

**Mobile** – There is one digital (GSM) and one analog (NTM 450i) cellular network operating in Bulgaria. Mobiltel is operating the GSM network, covering 90% of the population and providing the full range of services using simultaneously the frequency ranges 900MHz and 1800MHz. The analog network is provided from RTC Mobikom with a 95% coverage of population. The mobile market has experienced a significant boom concerning subscribers (from 6% in beginning 2000 to 15% end of 2001).

**Cable** – A big number of small cable operators providing TV services are operating in the country. The bigger players are moving towards providing integrated services through their networks. At this point cable operators technology is considered low and the services provided in high prices. In addition, their number exceeds 700 and consolidation is necessary.

**Internet-** At this point there are more than 200 ISPs providing connection through dial-up, ISDN, leased lines and ADSL. The more advanced of the provide internet telephony services too.

**Satellite** - Bulgarian licensed operators use the technical possibilities and services of about 10 satellite operators and satellite organizations, among which are INTELSAT, EUTELSAT, TELENOR and INTERSPUTNIK, both for “point-to-point” transmission and television and radio broadcasting, and for VSAT corporate networks and efficient Internet access through satellites on inclined orbits (geostationary satellites being taken out of operation) that offer Internet capacity at lower tariffs.

### **Telecommunication equipment and infrastructure manufacture**

Almost all telecom equipment in Bulgaria is imported. Major international companies such as HP, Cisco, Lucent technologies, Nortel, Siemens, Alcatel and others are present in the country, importing all types of telecom equipment. However, There is a small number of local producers of digital and analog branch exchanges, transmission systems and access equipment. From the total market size of 139 million USD, local production covers only 10 millions.

## **2. What are the technology needs of the sector?**

Demand from companies are expressed for the following technologies by category.

### **□ Fixed telecommunication :**

1. Demand for International Cable Systems and Microwave systems.
2. Demand for digital technologies for network (VAN, VPN) on provider (backbone) and customer (xDSL) side. Demand for optical technologies for broadband connections.

3. Unified messaging system technologies to replace the X.400 standard.
  4. Network management and maintenance systems
  5. Equipment (e.g. digital circuit switching, transmission and routing)
- **Mobile:**
    1. Technologies for GSM air interface and WAP protocol support
    2. Network management and maintenance system
    3. Equipment (e.g. digital circuit switching, transmission and routing)
  - **Other:** Multipurpose devices suiting all types of communication services in both top layer (terminal devices) and low and intermediate layers (routing, switching, etc.)

### **3. What is the innovation Capacity of the sector**

**Factor conditions** – Concerning labor skills there is traditionally a good level of education of the general population. However, ICT penetration in schools is still low. There are 23 regional academies and more than 40 local providing training in ICT related areas. In addition, the higher education system is considered as creating high quality scientists. The most prominent higher institutes are:

- Technical Universities in Sofia, Varna and Gabrovo
- Angel Kanchev University in Russe
- Institute of Electronics, in Botevgrad of the Sofia Technical University

Research activity is conducted in three research institutes in the telecommunications field:

- Institute for Scientific research in telecommunications
- Central laboratory for parallel processing of information
- Institute of computer and communications systems
- Institute for information technologies
- Center for Telematics services

The quality of research in these institutes is significant, focusing in offering services and result in the high end of technology and telecommunications is a considered target area from the Bulgarian government. It is characteristic that more than 20% of research force in the country is in the IT and telecommunications sector.

However, expenditure for R&D is small (0.6% of GDP) with limited participation of the business sector (more than 80% is government or HEI based research) and there is the additional problem of limited linkages between research institutions and enterprises for the exploitation of research. Structures, such as the Innovation Relay Center, the agency for Small and Medium enterprises and industrial associations (BAIT, BAI), the ARC Fund and the IZOT Business Innovation Center are working in this direction. There are also 6 international telecommunications related technology fairs organized every year in the country.

Finally, concerning access to capital, companies express significant limitations in terms of availability and cost of capital. Local banks are lending with very high interest rates and are in general negative to high risk loans. This gap is partly filled through a number of funds –mainly international- that support investments through grants, equity investments and also provide important technical advice.

**Firm strategy** - In general firms have a positive attitude towards innovation with substantial R&D effort although this is mainly internal and with limited cooperation with research centers and other companies through joint ventures. Firms have moved to the

services- based competition stage and as such they show an increased interest for new products and services. IT is used in almost all ranges of the companies' activities but demand is still directed towards networks and hardware rather than integrated solutions, resources management services and quality control-assurance systems. They also show significant interest in workforce quality. The workforce is skilled and 2/3 hold higher degrees and companies invest in further in-house training.

Concerning BTC, currently enjoying a monopoly status, it has strategy towards provision of new services, upgrading of current network and higher speed, use of new technologies. In addition, it participates in Joint Ventures with foreign counterparts for the development of information technology and telecommunication services, equipment and new technologies.

**Demand:** The sector is expected to grow substantially and demand for new services in both fixed (conventional and ISDN) and mobile services are expected to pull new investments in telecommunications and demand for new equipment and services. Telecom infrastructure and upgrading of network are boosting demand. The major drivers are

- the growth of internet penetration and demand for new services that require higher connection speeds and integration of services
- the high growth rates of mobile services and the gradual move from the 1<sup>st</sup> and 2<sup>nd</sup> generation to the 2.5 and 3<sup>rd</sup> generation service. Mobile telephony penetration is expected to grow in very fast pace during the next years as well as demand for advanced services.

The liberalization of the market has already created significant competition that is gradually moving from price-based to quality-based, pushing companies for introduction of new and higher quality services and needs for continuous technology upgrade.

**Related industries** - As we already mentioned there is a small production-assembly capacity of the local telecommunications equipment industry with low-end products orientation and sub-assembly. Compared to the SEE countries, there is a greater production activity covering 27% of the total sectors activities. It is also interesting that half of this production is exported, mostly to the Eastern Europe countries. It is expected that based on state procurement increase, short-term activity shall increase.

**Government role** – The government gives significant priority in the development of the sector and the provision of the full range of services in the country as a prerequisite for the Information Society, as well as the creation of a strong telecom industry in Bulgaria.

The main priorities for the coming years are:

- i. streamlining the legal framework with EU
- ii. strengthening the human capital in the country in the IT and electronics area
- iii. promote the creation of high tech parks
- iv. create financial support structures for new enterprises

#### **4. What is the legal framework**

##### **Responsible authorities**

- Committee on Posts and Telecommunications (CPT) responsible for state policy and regulations as well as setting national priorities for R&D in telecommunications.



- National radio frequency spectrum council controlling operations of the radio spectrum
- Commission for regulation of Telecommunications is the licensing and supervising authority in Bulgaria

**The present licensing framework is as follows :**

- individual licensing for: television and radio broadcasting (country wide and local); cable distribution networks for radio and TV signals and other services; mobile cellular networks (analogue NMT and GSM); paging networks and services; analogue and digital mobile TRUNK radio networks with local and national coverage; VSAT networks with control stations on the territory of the Republic of Bulgaria; earth fixed satellite stations; public data transmission networks,
- general licensing for: private data communications networks; mobile satellite terminals; installation and operation of public telephones; value-added services (services supplementary to the basic service for the relevant network)
- free regime: Internet accesses providers; short-range devices; fixed and mobile cellular network terminal devices

The incumbent state telecommunications provider (BTC) has been given monopoly rights over domestic and international telecommunication services until the end of 2002.

**5. What are the needs for innovation training of the sector**

Innovation training needs are mostly related to:

- managing change and improving transfer of research results to commercial applications and technology transfer mechanisms
- marketing skills are still considered low and it is necessary to improve in this area while the country is moving towards full liberalization of the telecom market.

**6. Next Steps for ITCB**

Based on the profile of the country it is evident that development in the sector is already on its way. Big multinational companies are present and as such the main development subjects are expected to be addressed through this channel. ITCB activities shall focus only on specific issues - target areas concentrating in research cooperations. :

- Following identification and initial assessment of the related research institutions, look for specific research cooperations and networking opportunities with similar Greek and other Balkan centers in the framework of EU research programs.
- Support-organize actions in the area of technology transfer skills through innovation management programs/seminars/workshops for relevant business and technology promotion-support agencies.
- Promotion of projects in the area of telematics networks in public services (e.g. health services, environment monitoring)

## B. FYROM

The country is characterized as of **low to medium** priority for ITCB mainly because of the dominating role of EU telecom companies (in contrast to EU). The sector is quite developed –more advanced than the total economy – but at the same time it has very limited research capacity and potential. The study, though, does not provide significant information since only 2 companies were included in the sample.

### **1. What is the technology status of the sector**

#### **Basic statistics**

Conventional fixed lines: 760000 lines/ 39 per 100 inh (2000)

ISDN lines: 1000 lines/ 0.5% penetration (1999)

Mobile lines: 170000/ 8.5 per 100 inh (2000)

Network digitization: 82%(2000)

Cable TV: No authorized operator

Fixed operators: Macedonia Telecommunications (monopoly until 2005)

Mobile operators: Mobimak GSM 900 Network. 105.000 subscribers (liberalized market, state licenses)

Public pay phones: 1570 / 0.78 per 1000inh (1998)

Total market size: 135million Euros (1999)

#### **Telecommunication service providers and network operators**

In general the level of existing technology in the sector is advanced in comparison to other sectors of the economy. Services provided are close to the international standard and continuous investments have enhanced network capacity and speed and allowed for new added value services. Existing technologies cover the full range concerning networking and support services, network maintenance systems and equipment (switches, fiber optic cables).

**Fixed network** – The PSTN has a capacity of 760000 lines (2000), 82% of which is digitalized while the backbone network is fully digital using optical cable (1900km installed by 2000) and SDH transmission technology. Macedonian Telecommunications is providing ISDN services in both basic (2B+D) and primary (30B+D) access form as well a number of additional services for subscribers.

**Mobile:** Mobimak is at present the only one operator (a second license was awarded to OTE) with a land coverage of 65% and population coverage of 95% and network capacity use of 55%. Planned investments are expanding capacity and increasing the range of services towards internet use.

**Data transmission services:** Makpak is the data transmission operator working with both Frame Relay and X.25 ports and provides access to global networks through foreign operators. The network allows services for data transfer, email, virtual private networks, internet access, etc.

**Internet:** MT is providing internet backbone network with the main POP in Skopje and six POPs of 2Mbps in other cities and terrestrial and satellite internet links with foreign backbone networks. Equipment used is imported (backbone routers, and Ethernet switches) and connection speed ranges from 56Kbps for PSTN connection, to 128Kbps for ISDN subscribers and 1Mbps for leased lines connection. The backbone

network is also used from the 7 (2000) Internet providers with Mtnet (MT subsidiary) controlling 45% of the market.

### **Telecommunications manufacturers**

No information was provided evaluating the capacity and technology level of the manufacturing sector that is very limited and with no significant production activity.

### **2. What are the technology needs of the sector?**

Demand-needs in the sector concern already existing technologies and the introduction of upgraded technologies providing higher connection speeds, broadband connection and integration of data, voice and video services. In addition there is need for advanced network maintenance and control systems and integration of geographic information systems.

In mobile services, technology is moving towards WAP technology and advanced second-generation services, customer care services, GPRS. In addition, demand for new modern devices and the whole range of equipment is expected to increase.

The 2 companies interviewed expressed particular interest for:

- Virtual private networks
- Wireless telephony technology, WAP
- Circuit switching
- xDSL
- UMTS

Opportunities are also present for the creation of advanced telematics networks and applications in public services.

### **3. What is the capacity for innovation?**

**Firm strategy** –MT is the dominant player in the region, controlling almost all activities in the sector. MT is involved in an extended cooperation with US based CISCO systems for backbone equipment provision, extension and upgrading of the present network in order to be fully inline with international developments. Following digitalization of the network a big range of services were added in the basic voice services.

However, based on the present monopoly position, MT is still not fully directed towards a services based view. There is limited internal R&D effort and technological development is based on the advances of the basic infrastructure.

**Support structure** – Concerning human capital, although the population has a relatively high literacy rate there is limited awareness of ICT and training in the specific sector. In addition, the phenomenon of brain drain is significant depriving the country of important skilled labor.

The relevant research centers are:

- Department of mathematical and technical sciences in the Academy of sciences
- Institute of Informatics wireless application laboratory
- Faculty of Electrical Engineering, Department of Computer Science

with relatively limited research capacity.

Concerning technology transfer activity, the main agency is the Commerce of Chamber that is organizing fairs and exhibitions (2 in the areas of telecommunications) and providing -among others- technology information, advertising and brokerage services and the Technology Watch center that is working in the areas of patent documentation and technology development.

**Demand** – Until now, demand was driven from network upgrading and request from operators for better technologies to improve backbone network capacity. This trend is expected to continue in the future, strengthened from the growth of information society services and movement towards integrated services that have just started to grow. Newly created companies are increasingly requesting telecommunication services to benefit from information society opportunities and services. Of course, a significant limiting factor is the small size of the country and the low purchasing power.

**Government support** – The government is trying to create an investment friendly environment for foreign investors providing a range of services through the Investment Promotion Agency. At the same time it has created the National Enterprise Promotion Agency in order to support new enterprises creation and development. In addition to the services provided a number of credit providing schemes – mainly supported from international organizations – are providing financial support.

Concerning telecommunication services, the goal is to move towards provision of Another important parameter is the presence of high customs duty for imports of telecommunication equipment.

#### **4. What is the legal framework?**

**Responsible authorities** –The Ministry of Transport and Telecommunications responsible for general policy while the Telecommunication Administration is responsible for supervising of the market, licensing and manage radio frequencies. The Broadcasting Council of FYROM is responsible for the monitoring and improvement of the broadcasting law, prepares proposals for the competition and draft decisions for the awarding and revocation of concessions concerning the performance of the broadcasting activity

Macedonian Telecommunications (privatized to Hungarian Matav has the exclusive right, until 31 December 2004, to provide fixed voice telephony services, telegraphy services, telex services, public pay phone services, and leased line services, and to construct, own and operate fixed public telecommunication networks. Mobile services are liberalized, licenses provided in an individual basis and the same applies to paging services. ISP and data transmission services are fully liberalized.

#### **5. What are the needs for innovation related training?**

It is evident that –given the small number of communications technology trained people, there is need for technical training to improve the skill base of the country. It is also necessary to strengthen marketing and management skills since the country is moving gradually to a more open liberalized competitive telecommunications market.

#### **6. Next steps for ITCB**

The pictured described illustrates a very limited scope for action, among which could be:

- Promotion/support of events, trades, shows concerning advanced telecommunication products and applications
- Organize participation of the existing research centers in projects for use if advanced telecommunication technology (telematics for health, education, environment, transportation) in FYROM. Promote cooperation of public and private institutions and organizations.
- Support training events-programs-courses in telecommunications.

## C. ALBANIA

The telecommunications sector in Albania is characterized as one of **low priority** for ITCB because of the lack of competitive environment that could push for innovative products, the very limited research capacity of the country and support structures.

### **1. What is the technology status**

#### **Basic statistics**

Conventional fixed lines: 146000 lines / 4.5 lines per 100inh, 85% population coverage(2000)

ISDN lines: 1000 lines 0.03% penetration(1999)

Mobile lines: 15000 subscribers 29000 lines 5.2 lines per 100inh (2000)

Network digitization: 75%(2000)

Cable TV: -

Fixed operators: Albanian Telecom (monopoly until December 2002)

Mobile operators: AMC (liberalized market, state licenses)

Public pay phones: 700 /0.2 per 1000 inh (1999)

Total market size: 72 million Euros (1999)

#### **Telecommunication service providers and network operators**

During the last years significant investments have upgraded the quality and density of the network creating the necessary base to follow international developments. However, the density of the network in the rural areas is still very low and so far investments have concentrated in the main urban areas.

**Fixed network** - The fixed network is owned from the Albanian Telecom company (Telecom Shqiptari). In 1996 a new backbone system was built for the Tirana region and the old one was abandoned. In addition it owns international leased lines of 9.6kbps and 1500 ISDN have installed in the Tirana, Saranda and Pogradeci areas providing speeds of 64Kbps. Still, the network performance is characterized as low in terms of quality of lines and range of services.

**Mobile network** – The first GSM 900 operator has a network that covers a small part of the country and it offers only basic voice services and data subject to additional charge. The technology used is that of 1<sup>st</sup> and 2<sup>nd</sup> generation cellular technologies.

**Cable networks** – Do not exist in Albania

**Internet** – There are 13 ISPs in the country using satellite connection using wireless and xDSL for data transmission providing speed ranging from 64kbps to 1 Mbps.

#### **Telecommunication equipment and infrastructure manufacture**

There is no significant production activity in the telecommunications sector in the country.

### **2. What are the technology needs of Albania**

Demand from the companies was expressed for the following technologies covering the whole range:

#### **Fixed telecommunications**

- e. International satellite systems
- f. ISDN
- g. Digital backbone system
- h. Network management system
- i. Microwave

- j. Wireless telephony
- k. Transmission equipment

At this point, the projects for increasing the density of a digital network and creating the basic backbone are creating opportunities in a broad range of technologies and telecommunications equipment.

### **Mobile telecommunications**

- Transmission equipment
- Network management systems
- Telephone centers
- 1<sup>st</sup> generation cellular technologies

### **3. What is the innovation capacity of the sector**

Albania started from a very low point in telecommunications in term of infrastructure and technology status. The innovation capacity in the sector is close to zero and technological developments are based on government investments supported from international organizations as well as from the few network operators.

**Support structure** - There are two related education-research centers in the country:

- l. Telecommunications division in the department of electronics of the Polytechnic University of Tirana
- m. Institute of Informatics and Applied mathematics

but there is no assessment off their potential for innovation.

Concerning the presence of skilled labor, it is scarce at this moment and the government is attempting to restructure the education system with the help of international funds attempts, create new vocational training centers. IT is considered as one of the priority areas.

Concerning business support:

- n. Albanian Development Agency
- o. The Center for foreign investments promotion
- p. Albania Development Fund

The major source of financing support comes through international funds from EU (EBRD), US (USAID) and the World Bank

**Demand** - The liberalization of the market and competition is expected to improve the supply of services and move companies to a service based competition slowly. At this point the driving force is the investments in infrastructure and ability to use new technologies. Growth rates are significant during the last years and together with developments of the business sector, demand is expected to rise fro a range of telecommunications services.

**Firm strategy** – At this point the few telecom companies in the country are based in new technology for upgrading. There is no internal research activity and very limited market (customer) oriented approach since they are still in the first levels of competition.

**Related industries** – At this point the companies are few. However, liberalization is expected to lead to the creation of new companies that will serve the different needs/roles in the industry. At this point, the survey revealed that in many case companies face problems of access/import of the necessary technologies because of a very weak suppliers channel.

**Government support** – Telecommunication infrastructure and services upgrading is considered as one of the strategic goals from the government, a critical parameter for the development of information society and knowledge economy in the country and placement of the country in the international picture. The strategy is aiming to streamline Albania with EU policies, procedures and standards. At the same time, the strategy is full liberalization and privatization of the market –stepwise- aiming at creating competition and improving the quality of services. Investment in infrastructure is considered as first priority and the government is intending to support such investments from private companies.

#### **4. What is the legal framework?**

**Responsible authority-** Telecommunication Regulation Authority (TRE) that implements the policy decided for the Ministry of Economy and Privatization. TRE regulates the frequency use, licenses services and supervises the operation of the market.

#### **Licensing framework**

- Fully liberalized: Data transmissions, Internet services , telecom equipment, paging, broadcasting and cable TV
- Individual licensing: Mobile telecommunications
- Monopoly: Public infrastructure, leased lines, domestic and international communication.

The government has liberalized the provision of local communication services and network in order to achieve faster deployment of telecom infrastructure.

#### **5. What are the needs for innovation related training**

The major needs in the country are for technical training in the areas of telecommunications both in vocational/technical level as well as for higher education. In addition, the opening of the market to competition and the continuous upgrading of technology, technology transfer and provision of new services there will be significant need for management of technology as well as for marketing skills.

#### **6. Next steps for ITCB**

The picture illustrated shows that there are many changes to happen during the next years in the country. The focus area is on services, exploitation of technologies and strengthening of technology management skills as well as

- Create links with the research institutions in the country, assess their actual capacity and promote their participation in specific research projects in the sector with an attempt to improve their facilities and expertise.
- Identify technology transfer agencies and promote activities (workshops, training courses) to strengthen their human capital capacity in technology transfer services.
- Help in facilitating the problem of access to new technologies through
  - i. Support telecom technology fairs and events that could increase awareness in new telecom technologies and promote possible initiatives.
  - ii. Creation of Internet based marketplace for telecom technologies and services.

## D. Romania

The sector is characterized from the study as one of **high** perspectives for technology transfer based on a significant production and research base and at the same time the presence of significant needs of the telecommunication network and introduction of advanced telecommunication services.

### **1. What is the technology status of the sector**

#### **Basic statistics:**

Conventional fixed lines: 17.5 per 100 inh (4 in rural areas and in some regions no connection at all) (1999).

ISDN lines: almost 0 (2000)

Mobile lines: 6 per 100 (1999)

Network digitization: 63% (2001)

Cable TV: 10% of households (35% of lines)

Public pay phones: 1.5 per 1000 inh

Fixed operators: RomTelecom (Monopoly until January 2003)

Mobile operators: 4 operators (2 GSM, 1 NMT-450, 1 DCS-1800)

#### **Telecommunication service providers and network operators**

**Fixed network** - The fixed lined services are provided from RomTelecom that holds monopoly until 2003. The company has installed 4.8 million lines in the country of which 2.8 are digital. ISDN services are available but penetration so far is very low.

**Mobile** -The 4 mobile services providers have invested significantly for the creation of an extended network. More specifically:

- The NMT-450 provider SunTel is based on the Low Emmission Mobile System, launched in 1999.
- The two GSM providers have a coverage of 73% and 90% of population (2000) and at this point they are providing, besides the basic telephony services, Internet and e-mail services using the WAP system.
- The DCS-1800 provider started operating in 2000 and it is currently providing Internet and e-mail services using the WAP data-transfer system.

**Satellite communications** – The National Radio Communications Company has a satellite earth station used for data communications and international phone services and TV broadcast. In addition, with an extensive fiber optic network and radio transmitters network it owns a significant backbone used from ISPs and large organizations and is connected with RomTelecom backbone. Through this advanced backbone a full range of advanced communication services (ISDN, Frame Relay and ATM) are provided. In addition to National Company a number of private companies offer data communication services and Internet access through a combination of leased lines, wireless radio systems and VSAT satellite connections.

**Cable network** - The National Radio Telecommunications Company has invested in the creation of an extended network based on SDH (Synchronous Digital Hierarchy) digital radio-transmitters providing high transfer rates and a platform for a range of services such as ISDN, LAN and WAN, Video on Demand, ATM and High Definition Television. The network covers at this point 50% of the population and it will be able to be the



second player in the telecommunications infrastructure market after the full liberalization of the market.

**Cable TV** - Cable TV has succeeded in Romania and at present more than 50% of households have cable TV. However, the technology used is mostly (97%) air build increasing vulnerability and quality of provided services. In addition, only 10% of the network is bi-directional allowing for customer interaction. Network bandwidth is more than 450MHz for more than 20% of the existing networks.

**Wireless network** - The first 3.5GHz wireless network was established lately providing service in the Bucharest area offered exclusively for companies.

**International networks** - Romania is also an active partner in several international telecommunications networks both inside and outside Europe such as:

- KAFOS: in services since 1997, this submarine cable system links Romania (Mangalia) with Bulgaria (Varna) and Turkey (Istanbul). KAFOS offers connection opportunities to other regional networks: TEL, TAE, ITUR, etc. RomTelecom owns 17.9 per cent of this partnership.
- BALTICA is a high reliability alternative extending towards the Nordic countries.
- TEL is an optical bridge, 14000 Km long, between Eastern and Western Europe.
- TAE is a 27000 long optical fiber network connecting 29 European and Asian countries from Frankfurt to Shanghai.

### **Telecommunication manufacture subsector**

The telecommunication equipment market in 1999 reached 1600 million USD while local production reached 600 million USD. The sector is comprised of few local producers that are subcontracting production from foreign companies as well as multinational affiliates based in the country.

The main products are:

- q. analog and digital switching equipment
- r. data transmission systems
- s. electric cables
- t. fiber optic technologies
- u. telecom hardware
- v. telephone terminals public card phones
- w. radio communications equipment
- x. GSM base stations

So far, the industry is oriented towards the domestic market and there is limited exporting activity. Still, there are few big companies, owned from foreign multinationals that have diversified production and are competitive.

## **2. What are the technology needs of the sector**

The needs and opportunities of the sector are for all types of technologies concerning fixed, wireless services both the operators and infrastructure side as well as in the customer side. The study did not provide specific answers to this question, naming specific types of technologies having priority for investment of research activity.

Still, it could be inferred that technology opportunities are in the following areas:

- y. network quality and security control and maintenance systems
- z. public telematics services- networks in transportation, health, culture and education sector, environmental monitoring tele-networks
- aa. digital wireless network systems for rural areas

In addition, it is evident that the continuous upgrading of the backbone network creates opportunities for the whole range of advanced equipment/services provided. Major opportunities are for ISDN, xDSL, and virtual networks.

In the telecommunication-manufacturing sub sector priorities expressed are for:

- bb. Use of computer aided design in manufacturing
- cc. Quality testing laboratory

### **3. What is the innovative capacity of the sector**

**Support structure** – Romania has a significant research capacity in terms of human capital and the sector shows a significant concentration of researchers in comparison to other research areas. The main telecommunications research centers in the country are:

- dd. National Communication research institute (INSCC)
- ee. National R&D institute for informatics (ICI)
- ff. National institute for studies and researches in communications
- gg. National design institute for telecommunications - Telerom
- hh. National Research and Development Institute for Microtechnologies – IMT

with significant research capacity. The telecommunications sector is considered as one of the strong research sectors of the country. There is also a number of private research centers in the areas of telecommunications and informatics such as the Ericsson Academy that cooperate with higher education institutes in the country. The education system is considered of high caliber and around 5.000 IT students enrolled every year in the country's institutions telecommunications and informatics specialized departments spread in the different regions of the country.

However, a significant problem during the last years is the phenomenon of researchers migration in Western countries, depriving the country from the top quality researchers and technicians.

The government is supporting a number of activities for technology transfer and innovation support coordinated from the National Agency for Science Technology and Innovation that is organizing the implementation of the program for Technology Transfer, Stimulation and Dissemination of Innovation extending to 2010. In addition there is an advanced structure of technology transfer agencies and organizations like:

- FEMIRC Innovation Relay Center
- Technology and Business Incubating Center
- Regional chambers of commerce and industry

And the related Business associations:

- ATIC - Association of Information Technologies and Communications of Romania (<http://www.atic.org.ro>).
- ARIES – Romanian Association for Electronic & Software Industries (<http://www.aries.ro>)

- ROMINFOR - Romanian Association for Research in Communication and Information Technologies (<http://www.cef.pub.ro/rominfor>)
- APRCC – Romanian Cable Communication Professionals Association (Asociatia Romana pentru Comunicatii prin Cablu Profesionale)
- INFOREC – Romanian Association for Promotion of Higher Education of Economic Informatics (Asociatia pentru promovarea învățământului superior de informatica economica)
- ARCA – Romanian Association for Audiovisuals Communications (Asociatia Romana de Comunicatii Audiovizuale)
- National Association of Romanian Exporters and Importers-Foreign Trade Promotion Centre SA -*Informational Systems Department* (<http://www.aneir.ro>)
- ANISP – National Association of ISP (Asociatia Nationala a ISP din Romania)

Romania has eliminated tariffs for IT products falling under the WTO IT agreement. In terms of financing, a number of international development projects and funds are supporting telecommunication infrastructure projects. Still, companies refer to credit availability as a major restricting factor for development of company activities.

**Firm strategy** – The survey revealed a general positive approach of existing firms towards new technologies and products but their activity does not go further than the modification of products to meet specific customer needs. Firms do pay attention to the quality of their labor force and the big majority holds a higher degree, although there is very small share of PhD or master holders.

Concerning their strategy for new technologies it is based on adoption of acquired technologies and customization of new products to local needs and does not go further to own design of new products. Firms are in general positive to collaboration with external players for development projects but this does not extend to R&D for new products for a longer-term perspective. The strategy is mostly focused in current business. In addition, they are in continuous contact with the market and the technological developments and invest in upgrading of production processes. The sector in total is characterized as viable and one of the most progressed in the country. Finally, there is actual interest for the introduction of ISO 9000 and other quality standards to ensure compliance with the technical requirements set in EU in order to secure export potential and improve quality of products.

**Demand** – The total market size in 2000 was 1695 million EUROS and it is expected to grow significantly in the future, including both the traditional services as well as new applications and services. Demand in the market is driven from the activities of the main telecommunication network operators in the fixed and mobile networks that are continuously upgrading their network.

**Government role** – Government strategy is directed towards attracting foreign direct investment, providing support services and tax incentives. The informatics and telecommunications reform program, was established in cooperation with the World Bank attempting to develop and expand the infrastructure and the services provided to the Romanian people as well as to create a fully functioning market.

In addition it wants to promote exporting activity of the telecom industry, seen as one of the core and dynamic sectors of the economy. The law passed last year regulates the creation of industrial parks, with specific interest for IT, where significant incentives are given for companies established.

#### **4. What is the legal framework**

Being a signatory to the WTO Basic Telecommunications Agreement the government has committed to create a free market for telecommunication services and creating the adequate legal framework.

**Responsible authority** – The Ministry (former National Agency) for Communications and Informatics regulating telecommunications services and provides operating licenses.

**Operative licensing framework** - According to the telecommunication law all activities are fully liberalized with the exception of domestic, local and international voice telephony services and networks where RomTelecom (partially privatized) is holding exclusive rights until the end of 2002. However, there is liberalization of the provision of services in rural regions to be granted by tender and where RomTelecom is not allowed to participate.

Since January 2001 there is complete liberalization of data transmission, VSAT and paging services, terminal equipment and partial liberalization (individual licensing) of mobile digital services and leased lines.

**Intellectual property rights** – One significant problem is the weak copyright system in Romania that leads many companies, especially the multinationals based in Romania to apply for EU or American patents for new products developed in the country.

#### **5. What are the needs for innovation related training**

Despite the presence of this significant number of support structures for technology transfer, the limiting parameter is the lack of experience in the specific set of activities. In addition the sector needs skills for marketing of products given the export orientation of the manufacturing sub sector.

#### **6. Next steps for ITCB**

Based on the picture provided, we could say that ITCB actions in the sector shall focus in:

- Create contacts with relevant telecommunication research centers in Romania and identify their core competencies
- Organize training programs -workshops and seminars- focusing on technology transfer skills
- Promotion of joint projects among research centers (public and private) or SMEs in Romania and Greece or other Balkan countries to help network creation and intensify participation in EU networks
- Focus areas can be the network control and security systems as well as telematics applications in telematics services (environment, health)

## **2. References**

In addition to the studies and data provided from the companies we also used the following supporting documents for each country:

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2. Information Society Promotion Office ESIS Knowledge base, Basic facts and indicators, [http://www.eu-esis.org/script/form\\_simple.cgi](http://www.eu-esis.org/script/form_simple.cgi)
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5. Factbook 2000, Romania country commercial guide 2001 –Wireless communication equipment market overview,  
[http://www.factbook.ro/countryreports/ro/ComRoWireless\\_MktOview.htm](http://www.factbook.ro/countryreports/ro/ComRoWireless_MktOview.htm)

**APPENDIX H:** Information and Communication Technology Development in the Balkans: System-wide Policy Guidelines for the Development of Information and Communication Technologies in Countries of South-Eastern Europe and Analysis of the Suitability of Public-Private Partnerships. MIT Master's' Thesis by Christos D. Sermpetis, January 2004, supported by the Initiative for Technology Cooperation With the Balkans (the ITCB) and the Southeastern Europe Telecommunications & Informatics Research Institute (INA telecom).

## **APPENDIX I: PROPOSAL FORMAT FOR ITCB SUPPORT**

1. Title of the Proposed Project:
2. Institutional/Individual Applicant(s):
3. Address, Telephone, Fax, and E-mail Contacts:
4. Abstract of Project (1 page maximum)
5. Problem to be addressed and project narrative (3-10 pages)
6. Goals/purposes of the project and its relationship to the ITCB mission
7. List of Research Tasks
8. Detailed discussion of research tasks and their relevance for achieving the goals of the project
9. Management Plan: institutions and individuals responsible for carrying out the project
10. Timeline by tasks
11. Detailed budget, including cost-sharing, external contributions, and sources and likelihood of next-stage funding beyond the ITCB initial funding
12. Experience of the participating institution(s) and individual participants.